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THESIS

entitled

The effect of the substitution of grass silage for roots on the intensity of production on East Lothian Farms.

Submitted

by

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CONTENTS

In recent years several farms in East Lothian have either stopped growing swedes entirely or have reduced the acreage considerably. Arable silage was made as a substitute for roots in some cases but this practice has almost died out and had been replaced by the making of grass silage and, in a few cases, a return to roots.

The reasons for arable silage falling into disfavour were the cost compared with grass silage, difficulty in handling, and the fact that normally only one cut per year was possible with very little regrowth for a second cut or grazing.

There are several reasons for giving up swedes completely or of reducing the acreage. They come under the following headings.

Labour The cost of labour, especially casual labour, is becoming higher and higher. Singling, weeding, topping and lifting of roots have a high demand on labour.

Yield Several diseases depress the yield very considerably and can make the crop a complete failure. The main ones experienced locally are clubroot Plsmodiophora Brassicae, soft rot Erwinia Carotovora and mildew Erysiphe Polygoni.

Thus while the yield of roots in crops unaffected by disease is generally high in this area, poor yield, due to disease, is not uncommon.

Land In some areas the land becomes so wet in the winter that it is almost impossible to cart the roots from the field and handling in frosty weather, when the land would carry tractors, causes much damage to the roots.

The following table shows the acreages of of swedes and silage together with the sheep population by The Department of Agriculture Agricultural Statistics, Scotland, published by H.M. Stationery Office.

Acreages of Swedes and Silage in East Lothian

Year	Roots	Total Sheep	Grass Silage	Arable Silage
	Acres		Acres	Acres
1951	5,877	113,501	937	391
1952	5,938	125,385	1,256	308
1953	5,845	129,920	1,329	332
1954	5,660	125,541	1,441	132
1955	5,708	125,561	1,303	108
1956	5,404	122,335	1,348	122
1957	5,634	130,428	1,504	

It will be seen from these figures that roots are still by far the main source of winter keep and that they have only been replaced to a limited degree by silage. The picture is some-:what complicated by the fact that a proportion of roots are fed to sheep. Only one farm in the county feeds silage to sheep.

There are no reliable figures as to what percentage of the sheep were fed turnips or for how long. It is difficult therefore to say to what extent the increased silage production is at the expense of roots.

Before the year 1951 silage, hay and dried grass were given as one figure for these returns and therefore are of little help in this regard.

The increase in acreage of grass silage from 1951 to 1957 is quite marked.

The above table also shows the decline of the acreage under arable silage.

Objective

Many farmers would change to grass silage if they did not feel that a bigger acreage would be necessary to support a given head of cattle for the winter period. They feel that the number of acres for winter keep would be increased if roots were replaced by silage. If this were the case less ground would be left for cash crops such as grain, potatoes and sugar beet.

It is the purpose of this work to see if more or less acres are required for winter keep when silage is substituted for roots. There will also be some investigation as to what other factors influence the acres required for winter keep and the part which sugar beet tops play in a winter feeding programme.

This may be summed up in the question. Does the replacement of roots by grass silage increase or decrease the acreage required for a given amount of winter keep and what other factors are of importance in determining the acreage required?

Description of the area

The area is mainly an arable one producing grain, potatoes and sugar beet as cash crops and the livestock mainly beef cattle, many of which are imported as stores from Ireland. A consider-:able amount of dairying has been introduced and sheep farming is more important towards the Lammermoors. It is mainly with the coastal area of arable and beef farms that this work is concerned.

In the county there is a tendency to buy in younger animals in some cases and keep them for two winters and one summer instead of the tradit-:ional method of buying in one or even two successive groups of mature cattle to fatten in 3 or 6 months. This does not seem to have affected the roots or silage question materially.

Self-feeding of silage is being practised on a few farms and is attractive from the saving of labour but control of silage eaten and adaptation of housing are problems still to be overcome in many cases.

The handling of roots for cattle is now pretty standard. They are mostly precision drilled at about 2 inch spacing to enable easier singling and are carted into the steading in advance of requirement so that if carting is held up by weather conditions there are always some in reserve in the steading. Singling is usually done by hoe with farm labour aided by the women-folk working on piece-work. Irish labour is occasionally employed on piece-work.

Topping and carting is usually done by the farm staff as time and weather permit. Quite a store of roots are accumulated in the steading if weather is good and other farm operations well advanced. In very wet heavy fields all the roots may be lifted before the end of the year.

Thus the peak labour demands are about May for singling and a rather less concentrated demand throughout the winter.

Silage is generally made from Italian ryegrass and red clover - a one year mixture sown the previous year under a nurse crop cereal - generally barley. This grass is fairly heavily manured especially with nitrogen, early in the spring. Sixty to seventy pounds nitrogen are given and the first cut is taken any time after the beginning of May. The grass is usually cut

with a reaper and transported to a pit or clamp by a buckrake or in a trailer loaded by a green-:crop loader. Wilting of the material is some-:times, but not generally practised. The introduction of machines which cut, chop and deliver the crop into a trailer is gaining ground and it looks as if they will be in general use soon.

The silage is generally made in a pit or clamp with sides of various materials. It is rolled by a tractor to give consolidation and in the great majority of cases preservation of the material is good. After cutting, the field is immediately fertilised and later a second cut for hay or silage taken. The growth of this second cut may be very rapid or very slow according to rainfall. Leys or permanent pasture are some-:times manured and a cut of silage taken as a regular practice or when there is a temporary unexpected surplus of grass for grazing.

The exact stage of cutting the grass varies but it is usually just before the seed head emerges. It is very difficult to compact over-mature, unchopped material and this is possibly the main source of loss encountered.

After the second cut the foggage is generally grazed by cattle or sheep.

The silage is thus made, generally near the steading, before the onset of winter.

The amount of labour involved feeding silage as opposed to roots depends very much on the design of the buildings and the methods of handling. In general, however, unless self fed, silage requires a little more labour in feeding.

The relative importance of roots and silage as part of a ration is very similar, the general practice being to feed little in the way of concentrates, straw ad lib. as it is plentiful in this area, and a variable amount of hay.

Sugar beet tops are an important part of the ration on many farms and as they do not keep well unless ensiled the general practise is to use them as a replacement for roots and/or silage until the tops are finished. Thus the tops are fed fresh or only partially wilted, and may be used right on till the end of the year if the beet is harvested at intervals. The tendency now is to pay attention to saving the tops for feeding and they are less often ploughed in than a few years ago. This is probably due to more efficient machinery which can keep the tops from being contaminated with soil. Sugar beet top silage is very seldom made in the area as this is thought unnecessary labour. By lifting at intervals over a longer period the tops may be fed fresh or partially wilted.

Although the tops are often fed very fresh no case has been reported where there has been trouble from the oxalic acid content. This may be due to the fact that cattle are seldom fed on tops for more than ten or twelve weeks during which time the animal's reserve of calcium may not be dangerously depleted.

Resume of literature

There has been a great deal of work carried out comparing silage and roots as the basis of a winter ration. One can find numerous references to the effect of feeding one or the other on the daily live weight gain, quality of the carcase and the relative weights of each required. There are also numerous references which point out that the quality of the silage is very important.

Nowhere however has it been possible to find a comparison of these two feeds on an acreage basis.

In comparing output per acre it was immediately obvious that some standard of measurement was necessary. Two types of measurement could be used, either some form of animal unit or some form of absolute unit. It was thought that the latter would be simpler and of more value. Three absolute units are in common use and these are: dry matter, starch equivalent and protein equivalent.

As the digestibility of the dry matter varies considerably with different silages and is seldom the same as the digestibility of dry matter in roots it was thought that this unit would not be as useful as starch equivalent.

No protein supplement is commonly fed to fattening cattle in this area as it is felt that a ration based on roots or silage, hay and straw gives adequate protein for fattening at the levels generally fed. It is obvious that in many cases where relatively high protein silage is fed that a considerable quantity of this protein will be burned for energy or used in fat production.

In view of these considerations it was decided to take the output of starch equivalent per acre as the standard of intensity of production.

It is realised that the position may be quite different under such condition as dairying where a relatively high protein requirement is necessary.

The estimation of starch equivalent per acre involves finding the total weight of crop per acre and the starch equivalent per 100 lbs. of crop.

In this work the actual not the potential yields have been measured and all results are those found under normal husbandry on the farms

considered. This is rather an important point as the growing of roots is almost standard and given good husbandry and average land, the yield per acre does not vary greatly from farm to farm in one season. The yield of silage however is greatly affected by such factors as timing of cuts and number of cuts taken.

The measurement of weight of crop harvested per acre varied with the method of harvesting and storing and will be dealt with later under the heading of proceedure.

Estimation of Starch Equivalent

In his publication on rations for livestock Woodman (1952) gives the starch equivalent of all the feedingstuffs that were used on the farms considered. It was felt that these values should be used as a basis but that some refinements should be made based on elementary analysis and observation of the condition of the crops at time of feeding. The following is the detailed consideration, with references, on which the starch equivalents were based.

Swedes

In comparing potatoes with swedes Paterson (1931) suggests that their feeding value is the same on a dry matter basis. Paterson (1933 & 35) compares swedes with potatoes, dried beet-pulp,

silage, and kale in rations for fattening cattle showing again that the dry matter is an important consideration. Bruce (1903-4) as quoted by an anonymous contributor to the Journal of the Board of Agriculture (1906-7) indicated that the dry matter per acre is the true criterion of yield in a trial where swedes of 10 and 13 per cent moisture respectively were fed to sheep. Woodman (1952) gives a figure of 7.3 for starch equivalent with a dry matter of 11.5. It was decided to use this figure of 7.3 multiplied by the dry matter of the roots and divided by 11.5 as the starch equivalent of each crop, thus making an allowance for varying dry matter content.

Silage

In comparing several silages all with a dry matter of about 21 per cent but with the per cent crude protein varying from 9.3 - 13.5 Dodsworth et al (1951-52) showed that fattening cattle made more rapid liveweight gain on the higher crude protein material. There was a lower rate of consumption of the silage as the fibre increased. Taken on average over a number of experiments they found 60-70 lb. of silage were equivalent to 100 lb. of swedes.

Morrison and Stephenson (1950) found high quality silage, without supplements, very satis-:factory as a fattening ration.

Summing up previously mentioned experiments in addition to new work Dodsworth et al (1953) found that silage with a low proportion of stem was the most satisfactory for fattening. They also found that with low dry matter silages the total dry matter intake was reduced. For routine analysis of farm silages the chemistry department of the Edinburgh and East of Scotland College of Agriculture use a graph, made by Moon F.E., in the determination of starch equivalent. The formula for this curve is based on the dry matter and crude protein content of the silage. It is derived from a wide survey of results (from the literature on this subject) of silage feeding trials. The scatter is rather wide but the method is felt to be sufficiently accurate for practical use and has been used in this work.

Sugar beet tops

It was found that a great deal of work on the value of sugar beet tops had been done by Rayns of the Norfolk Agricultural Station. In a feeding trial extending over four years and involving 79 bullocks in different lots Rayns (1932) found that one ton of swedes was equivalent to 0.93 ton of sugar beet tops. These bullocks commenced fattening at about 7.75 cwt. and finished at around 11 cwt. Beet tops were taken as the leaves and crown as normally removed before sending beet for

the extraction of sugar. These values are based on feeding trials not chemical analysis. Rayns (1943) found a loss in feeding value of 1.5 per cent per month after lifting.

Rayns (1945) gives an average dry matter of sugar beet tops of 15-17 per cent. Ivscavitch (1940) gives the following average analysis for sugar beet tops; sugar 19.19 per cent, crude protein 4.29, crude fibre 2.63, fat 0.24 and nitrogen free extract 6.42. He suggests that the feeding value is as would be expected from these figures. Guilbert et al (1947) estimate that the T.D.N. of sugar beet tops is 59.2 per cent of the dry matter. Woodman (1952) gives a dry matter of 16.2 and a starch equivalent of 8.5.

All the above results are very much in keeping with each other and it was decided to use a starch equivalent of 8.6 at 16.2 per cent dry matter modifying the S.E. directly in relation to the dry matter of the tops.

Hay

All hay was first year seeds hay and was a mixture of Italian ryegrass and red clover. For this type of hay Rutledge and Common (1947) give an average starch equivalent of 34.3.

Woodman (1952) gives a starch equivalent of 31.9. With similar material Ferguson and Watson (1944) found a range of 33.3 - 41.2.

Moon (1953) working with this same mixture in the Lothians found that under the normal manuring practice the starch equivalent ranged from 29.2 - 37.2.

It was decided to base the starch equivalent of the hay on the basis of the latter as it is most specific to the area concerned. The value allotted within this range was decided by observation of the following points; stage of growth when cut, weather while hay was being made and any evidence of heating in the bale.

Method of Approach

It was felt that a general survey of the feeding of fattening cattle in the county would be of some use but that a more detailed investigation of a small number of farms would be the best method of approach. By far the greater emphasis has been put on the detailed recording of four farms but a survey of a larger number has also been included to see how the four selected compare with the general trend.

The four farms selected are in the North Berwick and Drem areas which are typically arable with beef cattle as the predominating livestock. Two of the farms grow swedes as the main source of winter keep. One has no roots but makes grass silage. The other has a few acres of swedes and mangolds but is mainly dependent on grass silage for winter keep.

The farms were selected as being managed on a similar standard of husbandry and on land of much the same inherent fertility. Another important consideration was that these farmers agreed to co-operate, at very considerable inconvenience to themselves, in allowing the necessary weighings to be made and providing a great deal of information from their own records.

After some consideration it was felt that it would be an advantage to measure the starch

equivalent produced per acre for winter keep by two methods. The first method was to multiply the weight of crop per acre by the estimated starch equivalent of the material. The second method was to find the Starch Equivalent utilised by the cattle to which the crop was fed.

By making the measurement in two different ways it was felt that there would be a cross check on the results and that any difference in the efficiency of utilisation of the feeding value of the main constituents of the winter ration would show up.

From the outset it was realised that it would not be possible, under the conditions chosen, to measure every factor with the accuracy possible in a specially laid out feeding trial. It was felt however that it was important that the work be done under farm conditions and that the results should be sufficiently accurate to be of value.

The summer fattening of cattle on the grass in relation to the subject was considered and it was decided to estimate the output per acre as utilised for maintenance and liveweight gain, during the first summer. It was foreseen that although this figure would be of value in some cases it would be useless in others as the stocking of the grass was sometimes governed by

the current price of store cattle rather than the head of stock which it was capable of carrying.

Outline of the four farms

Bonnington Farm, North Berwick.

Land excluding buildings, roadways etc. 244 acres plus 7 acres of permanent pasture let to the farm.

Typical crop acreages:

Permanent pasture	27 acres	(including 7 let to the farm)
Rotation grass	113 acres	
Barley	101 acres	
Oats	10 acres	

The cropping policy is one of two years grass (a mixture of Italian ryegrass and red clover) followed by two years grain. The grass is sometimes seeded direct; otherwise it is sown under the second crop of barley which acts as a nurse crop. The grass is generally grazed the first year and then cut for silage, with a little for hay, in its second year. No other crops are grown on this farm.

About sixty Fresian bull calves are bought in the early autumn at a few days of age and are pail fed until going on to a ration of calf cake, hay and silage. These young calves are the only animals on the farm getting any bought-in feeding stuffs.

The calves are turned out to grass the following spring and get no supplementary feeding. Starting their second winter at about one year old they are self-fed silage with straw also ad lib. The second summer the cattle are grazed and a few may be graded fat. The rest are self-fed silage and straw for the winter and the ration is supplemented with oats after the end of December. All these cattle are now graded out of the courts.

Calves are bought in each autumn so that each spring there are cattle going to grass of approximately six months of age and another batch eighteen months of age. Each autumn there are calves a few weeks old and two batches of cattle, one year and two years old respectively. As high prices have been offered for store cattle recently, only twenty to thirty cattle have been fattened some having been sold the previous autumn or spring according to whether the price was attractive or not.

The structure of this system is thus very simple with grass for summer and winter keep and a large acreage of barley as a cash crop.

The cattle enterprise produces fat cattle or stores according to demand.

The silage foggage, after the second cut, is generally let to graze two hundred lambs for about eleven weeks.

West Fortune, Athelstaneford.

Land excluding roadways, buildings etc. 451 acres.

Typical crop acreages:

Potatoes (earlies)	62 acres
Mangolds	5 "
Sugar beet	24
Swedes	4
Permanent pasture	16
Rotation grass	113
Barley	151
Oats	16
Wheat	60

There is no definite rotation but the following principles are adhered to; wheat follows potatoes, potatoes follow grass and not more than two white crops are grown in succession. Grass is sown for variable periods of from one to three years. All grain is undersown with a catch crop of Italian ryegrass and red clover which is grazed by sheep. The potatoes are all earlies and no catch crop is sown before the wheat.

The stock policy is mainly one of buying-in suckled calves in the autumn. These are wintered then put to grass in the summer to be fattened the following winter. These are supplemented by the buying in of some stores in spring or autumn or both as required.

The calves are wintered on sugar beet tops and hay, followed by silage and hay. The fattening cattle get the same feeding plus a limited quantity of concentrates and a few roots. All animals get

straw ad lib.

Congalton, Dirleton.

Land excluding buildings, roadways etc. 295.5 acres

Typical crop acreages:

Potatoes (earlies)	33 acres
Sugar beet	17 "
Swedes	24 "
Permanent grass	34 "
Rotation grass	42 "
Barley	83.5 "
Oats	24 "
Wheat	38 "

The rotation aimed at is potatoes, wheat, oats, roots, barley and hay. This rotation is not very strictly adhered to as can be seen from the above acreages. This farm is well known for having exceptionally fine crops of sugar beet.

The stock policy is almost identical with that at West Fortune except that swedes are fed instead of grass silage.

Highfield and Sydserf, Dirleton.

Land excluding buildings, roadways etc. 545 acres.

Typical acreages of crops:

Potatoes (maincrop)	80 acres
Sugar beet	30 "
Swedes	34 "
Mangolds	3 "
Permanent pasture	36 "
Rotation grass	90 "
Barley	170 "
Oats	22 "
Wheat	80 "

The rotation for two-thirds of the farm is potatoes, wheat, barley roots and sugar beet, barley and hay.

For one-third of the farm, which is heavier land, the rotation is potatoes, wheat, barley, barley, grass and grass. Wheat crops on this farm are very good.

The stock policy is one of buying-in stores, mainly in the autumn. Some stores are bought in the spring, however, of which some fatten on the grass but the majority are finished in the courts the following winter. The number bought in the spring depends on the price and some fields may be let or undergrazed if the price is high. Most of these stores are Irish but a few homebreds are also fattened. The cattle on this farm are more finely boned than on the other three farms.

Procedure (General considerations)

During the winter 1955-56 observations were made on the harvesting methods and feeding practices on the four farms. This was done with a view to deciding the best methods of measuring the weights of the different feeding stuffs fed to the cattle.

It was found that the amounts fed per day were not quite constant in all cases but that there was very little wastage in the handling of silage,

roots, and hay and very little wastage of sugar beet tops once they had left the field. It was therefore decided to measure the weight of each feedingstuff as follows.

Swedes. Measurement of the crop in the field by taking the weight of roots in measured areas taken at random throughout each field.

Silage. The cubic area of the pit multiplied by the weight of a cubic foot of silage. For this later measurement a metal box specially constructed with a cubic capacity of exactly one quarter of a cubic foot was used. This box was driven into the silage at the surface, halfway down the pit, and at the bottom of the pit. The average weight of the silage contained in the three instances was taken as being the average weight of one quarter of a cubic foot of silage in the pit. This box was kindly lent by the chemistry department of the Edinburgh College who had used it for comparing the density of different silages.

Hay. It was decided that the most accurate method of measuring the yield of hay was to weigh bales at random and multiply the average weight by the number of bales harvested.

Sugar beet tops. Measured drill lengths were taken and the tops and crowns from each length were collected and weighed. As the drill widths were known the area represented by each length was easily found.

Concentrates. The farmers agreed to keep a record of concentrates consumed. This was fairly simple as most of the homegrown concentrates and all the bought-in feeding were fed from weighed bags.

Straw. It was soon obvious that any measure-:ment of straw would be impossible as cattle ate as much from the bedding as from the racks. It is the general practice in this area to bed the courts liberally and there is often a considerable amount of good straw in the bedding.

Procedure

In the spring of 1956 all the cattle on the four farms, with the exception of some young calves were weighed as they were put out to grass. From the appendix it will be seen that a large number of cattle, approximately 300, were weighed. This was a big undertaking as none of the farms concerned had provision for weighing cattle. The Scottish Agricultural Industries very kindly gave the use of a machine which they use for this kind of work. This machine consists of an ordinary cattle crush and a crane mounted on a lorry. A large spring balance is hung on the crane hook and attached to the cattle crush. Each animal is weighed by lifting the cattle crush with the crane and subtracting the weight of the crush from the reading on the spring balance. The time taken for weighing depended very much on the arrangement of holding pens for the cattle and was much easier on one farm than the rest. A large number of people were necessary to do this work and the farmers were very generous in making their staff available for this work.

The weights of each group of cattle were recorded separately and kept separate as far as possible. In some cases there was so much inter-:changing between fields grazed that this was not possible. Consideration of each farm separately:

Highfield

The cattle were weighed in three different groups and weighed into the courts in the autumn in these three same groups.

All the grass grazed was given 3-4 cwt. of a manure containing 12 per cent nitrogen. Some sheep were grazed over grain stubble, swedes, and sugar beet tops but they did not compete with the cattle for grass and the areas of roots and sugar beet tops grazed by them are deducted to give the acreage for winter keep for cattle.

Bonnington

The cattle here are divided into two groups - calves and heavier cattle. All the grazed grass here was given 4 cwt. of a compound fertiliser containing 8 per cent nitrogen and 4 cwt. of a fertiliser containing 15 per cent nitrogen.

It was not possible to arrange for the cattle on the other two farms to be weighed in the autumn as petrol rationing was in force. Estimates were made in each case on the basis of all information available.

Congalton

The cattle on this farm have been taken as one group as there was much changing about from field to field due to the shortage of grass during the spring. More than half of the pasture is on shallow soil and some of it is wooded.

All the grazed grass was given 5 cwt. of a manure containing 10 per cent nitrogen.

West Fortune

All the cattle were run together for much of the time and moved from field to field. The pasture on this farm was poor during the spring and the cattle did not thrive during the early part of the grazing season. All the grazed grass received 4 cwt. of a manure containing 10 per cent nitrogen.

Only the nitrogen content of the manures is given as it is felt that all the land in question will have, or has been given, adequate phosphate and potash to utilise these levels of nitrogen. This finding comes from the routine soil analysis carried out on these farms by the Edinburgh College. It is felt that in some cases higher yields would have been given by increased application of nitrogen.

The latter two farms, Congalton and West Fortune, were more affected by the dry spring of 1956 than the other two farms.

The starch equivalent utilised from the grazing was calculated by giving an allowance for maintainance and an allowance for liveweight gain. All figures for this were taken from the publication of Woodman (1952). Maintenance was

based on the average weight for the grazing period which was taken to be the average weight of each group going to pasture plus half the weight gained over the grazing period. The starch equivalent allotted for gain was determined by the live weight gain in pounds which was found by the difference between the spring and autumn weighing at Bonnington and Highfield for the larger cattle. The autumn weights at Congalton, West Fortune and the younger cattle at Bonnington were estimated on the basis of the first two farms and the condition of the cattle as they were brought into the courts. The number of pounds of starch equivalent per pound live weight gain was allotted in accordance with Woodmen for age and condition of the animals.

One field at Bonnington was grazed by sheep. The weekly allowance for the sheep was also taken from Woodman.

For details of cattle and sheep grazing see Appendix Summer Grazing 1956.

Summer Grazing 1956

The following table shows the starch equivalent utilised on the different fields and on an acreage basis

Farm	Acreage	Type of grass	Total S.E. in lb.	S.E. per acre in lb.
Highfield	41	Permanent	85,778	2,090
	15	Rotation	36,669	2,445
	12	Rotation	19,918	1,660
	24	Rotation	9,024	376*
Bonnington	36	Rotation	68,601	1,906
	38 (20	Permanent		
	(18	Rotation	90,116	2,372
	66	Rotation	26,928	408‡
Congalton	53 (33	Permanent		
	(20	Rotation	77,648	1,465
West Fortune	58 (12	Permanent		
	(46	Rotation	103,661	1,787
	40	Rotation	23,694	592*

* These fields were grazed by cattle for a short time after hay.

‡ These fields were grazed by sheep for a short time after silage and hay.

It will be seen that the starch equivalent utilised per acre varied considerably from field to field and farm to farm. This was not always due to a poor pasture on the fields where the output was lower, as some fields were understocked. The 15 acres at Highfield which gave the highest yield utilised per acre were not stocked to potential. This simply means that these results are of limited use and only show that in this season good rotation grass, well manured, could under extensive grazing, give a utilised output of approximately 2,500 lb. starch equivalent and possibly more. The best permanent pasture gave a

utilised output of approximately 2,000 lb. of starch equivalent but the figures do not show whether this is because it is permanent or rotational pasture or because it was not stocked to its potential level. For the greater part of the summer both these fields looked undergrazed.

It is felt that the only real value of this summer grazing study was to show the utilised output by grazing from fields which were mainly for hay and silage for winter keep.

It was also fortunate that the cattle at Congalton and West Fortune were weighed in the spring as it made it possible to give a more accurate estimate of their weight for the winter trial in the autumn when it was not found possible to weigh them again.

Estimation of winter keep for 1956-57 by direct measurement.

The method by which the weight of each crop harvested was measured is discussed on pages 22 & 23 and the method by which the starch equivalent of the crop was decided is outlined in pages 10 to 14 The details of the calculations are in the appendix Winter Keep 1956-57, Direct Measurement. The following table gives a summary of results.

Summary of Crop Yields and Winter Feeding for 1956-57

(Details in Appendix Winter Keep 1956-57)

Farm	Crop or Feed	Acres of Crop	Yield per acre cwts.	Total Tons	S.E.	S.E. per acre lb.	Total S.E. from crop or Feed lb.	Crop or feeds as a % of total Winter Keep
Highfield	Swedes	25	600	750	6.3	4,243	106,076	37.5
	Hay	58	31	95	35	1,277	74,088	27.5
	Sugar beet tops	25	200	250	8	1,892	47,312	16.5
	Total Bulk Feeds	98				2,323	227,476	81.5
	Dried beet pulp			19	60		25,536)	18.5
	Barley (Screenings)			19	60		25,536)	
	Total						278,548	
	Hay ground	58 Including Grazing				1,433	83,113	
Congalton	Swedes	24	840	1,016	5.2 & 5.8	4,991	119,781	53.5
	Hay	22	27	30	35	1,098	24,147	11.0
	Sugar beet tops	17	250	213	8.6	2,293	38,984	17.5
	Total bulk feeds	63				2,903	182,912	82.5
	Proprietary Cake			2	71		3,180)	17.5
	Palm Kernal			2	73.7		3,279)	
	Thin oats and Dried beet pulp			24.5	60		32,928)	
	Total						222,289	
West Fortune	Silage	46*	60	140	15		) 96,091	41.0
	Silage	67*	40	146	15		)	
	Hay	21*	35	36	35		28,039	12.0
	Total from grass	67				1,853	124,130	53.0
	Sugar beet tops	24	150	293	7.65	2,092	50,200	21.5
	Mangolds	5	640	166	6.8	5,071	25,356	11.0
	Total bulk feeds	96				2,080	199,686	85.5
	Barley			5	71.4		7,997)	14.5
	Palm Kernal			4	73.2		6,559)	
	Dried beet pulp			15	60		20,160)	
	Total						234,402	
	Total from grass	67 Including Grazing				2,206	147,824	
Bonnington	Silage	66*	60	190	11.5)		119,928	93.5
	Silage	48*	100	250	12.5)			
	Hay	18*	15	11.5	30		7,856	4.0
	Total from grass	66				1,936	127,784	97.5
	Oats (Thin)			2.05	60		2,755	2.5
	Total						130,535	
	Total from grass	66 Including grazing				2,344	154,712	

*Some other yield or yields are recorded from this ground during the same season.

The variation in the S.E. of swedes and other crops is based on analysis of samples. Where more than one figure appears the acreage is made of more than one field and the field samples have different values on analysis.

The yield of swedes at Congalton was quite extraordinary and considerably better than the farmer himself had ever seen on the farm.

The first cuts of silage at Bonnington and West Fortune were well below the average in yield for first cutting on these farms.

The acreage of hay at Highfield was much higher than normal as a field of 24 acres for grazing was cut for hay, as store cattle were considered unreasonably expensive.

Manuring of the crops

Swedes received 10 cwt. per acre of turnip manure on both farms. The grass for silage at Bonnington was given 152 lb. of nitrogen per acre in two dressings and at West Fortune 140 lb. of nitrogen, also in two dressings, was given. In both cases adequate quantities of potash and phosphate were also applied. Hay at Highfield and Congalton was given 2,5 cwt. of sulphate of ammonia (51 lb. of nitrogen).

The total S.E. given is that of feeds consumed by the cattle in this trial except at Bonnington where 4.5 tons of hay and 51 tons of silage, representing 17,970 lb. S.E., were fed to young calves not recorded in the trial.

It is felt that it would be advantageous to deal with the same set of results for the following year at this point so that comparison may be made.

Summary of Crop Yields and Winter Feeding for 1957-58

(Details in Appendix Winter Keep 1957-58)

Farm	Crop or Feed	Acres of Crop	Yield per acre cwts.	Total Tons	S.E.	S.E. per acre lb.	Total S.E. from crop or Feed lb.	Crop or feed as a % of total Winter Keep
Highfield	Swedes	28	660	924	5.54	4,064	113,801	38.5
	Hay	22	62	70	34	2,519	55,407	19.0
	Sugar beet tops	30	214	320	8.7 -9.35	2,197	65,899	22.0
	Total bulk foods	80				2,939	235,107	79.5
	Potatoes Brock			22	18.5		9,117	3
	Sugar beet pulp			12	60		16,128)	
	Barley (Thin)			24	60		32,256)	17.5
	Oats (Thin)			2	66		2,688)	
	Total						295,296	
Congalton	Swedes	20	560	560	6.16	3,900	77,989	36.5
	Hay	23	59	68	32	1,883	47,314	21.5
	Sugar beet tops	20	270	270	6.7	2,033	40,666	19.0
	Total bulk feeds	63				2,634	165,969	77.0
	Palm Kernal			4	73.2		6,558)	23.0
	Sugar beet pulp & light oats			32	60		43,142)	
	Total						215,699	
West Fortune	Silage	28	160	220	15		)	
	Silage	66	25	77	17		) 109,702	45.5
	Hay	38	42	96	33 &35.		73,542	14.5*
	Total from grass	66				2,776	183,244	50
	Roots	5	500	134	6.1 -6.3	3,734	18,668	7.5
	Sugar beet tops	20				1,883	37,650	15.5
	Total bulk feeds	91				2,633	239,562	83
	Palm Kernal			4	73.2		6,559)	
	Dried beet pulp			16.5	60.1		22,176)	17
	Barley			7.5	71.4		11,997)	
	Total						280,194	
	Total from grass	66 Including grazing				3,306	218,228	
Bonnington	Silage	47*	210	500	10.5		115,916)	96.0
	Silage	22*	70	80	14.0		24,923)	
	Total from grass	47				2,997	140,839	
	Oats			4	60		5,744	4.0
	Total						146,683	
	Total from grass	47 Including grazing				4,281	201,140	

*This figure of 14.5% is for hay actually fed. Approximately half the hay was sold or was on the farm at the end of the winter feeding period, as is shown in the appendix. The first cuts of silage were much heavier than in the preceeding year.

The variation in S.E. for swedes and other crops is based on analysis of samples. Where more than one figure appears the acreage is made of more than one field and the field samples have a different value on analysis.

The yield of swedes was considered by the farmers to be average or slightly above average.

The manuring of swedes, silage and hay on the four farms was the same as the previous year.

The total S.E. given is that of feeds given to recorded cattle except for 80 tons of silage at Bonnington with an estimated S.E. of 24,923 lb. and 46 tons of hay at West Fortune with an estimated S.E. of 38,086 lb.

<u>The following is a summary of the yields irrespective of farms</u>. 1956-57.

Grass mainly for silage	133 acres	Total S.E. 302,536 lb.
		S.E. per acre 2,275 lb.
Swedes	49 acres	Total S.E. 225,857 lb.
		S.E. Per acre 4,609 lb.
Sugar beet tops	66 acres	Total S.E. 136,496 lb.
		S.E. per acre 2,068 lb.
Grass mainly for Hay	80 acres	Total S.E. 107,260 lb.
		S.E. per acre 1,341 lb.

When grazing after hay and silage is disregarded and only winter keep from the grass is considered the figures are:-

Grass mainly for silage	133 acres	Total S.E.	251,914 lb.
		S.E. per acre	1,894 lb.
Grass mainly for hay	80 acres	Total S.E.	98,235 lb.
		S.E. per acre	1,228 lb.

The following is a summary of the yields irrespective of farms 1957-58

Grass mainly for silage			
	113 acres	Total S.E.	419,496 lb.
		S.E. per acre	3,712 lb.
Swedes			
	48 acres	Total S.E.	191,781 lb.
		S.E. per acre	3,994 lb.
Sugar beet tops			
	70 acres	Total S.E.	144,215 lb.
		S.E. per acre	2,060 lb.
Grass mainly for hay			
	45 acres		102,721 lb.
		S.E. per acre	2,283 lb.

When grazing after hay and silage is disregarded and only winter keep from the grass is considered the figures are:

Grass mainly for silage			
	113 acres	Total S.E.	324,083 lb.
		S.E. per acre	2,868 lb.

Grass mainly for hay - as above because no grass grazed after hay.

Detailed discussion of these results will be left till later but a few observations are made at this point.

The yields of both hay and silage were considerably higher in the second year of the trial.

The most likely explanation for this is the difference in rainfall during the growing period.

The following table shows the recorded rainfall as given by the meterological recording station near North Berwick.

Month	1956 Rainfall in inches	1957
January	2.07	2.01
February	2.15	3.07
March	0.84	2.06
April	0.64	1.38
May	0.54	1.32
June	2.31	0.95
July	4.80	4.15
August	5.87	4.18

It will be seen that in 1956 there was very little rainfall between the end of February and the end of May. The higher rainfall in June, July and August was too late to give high yields from grass. This was very obvious from the appearance of the grass which ran to seed, after the first cut, with very little leaf formation.

In 1957 the grass looked much more vigorous throughout the growing season and premature running to seed was not so common. There has been some change in the position of recording stations in the North Berwick area so that it is difficult to get figures for average rainfall but 1957 was considered to be more typical than 1956.

The yield of swedes and sugar beet tops is very similar in the two years and would thus seem to be less affected by drought in the early part of the year.

The following is a summary of the yields, irrespective of farms, for the two years taken together:

Grass mainly for silage 246 acres

Total S.E.	575,997 lb.
S.E. per acre	2,341 lb.

Swedes 97 acres

Total S.E.	417,648 lb.
S.E. per acre	4,305 lb.

Sugar beet tops 136 acres

Total S.E.	280,711 lb.
S.E. per acre	2,064 lb.

Grass mainly for hay 101 acres

Total S.E.	170,299 lb.
S.E. per acre	1,685 lb.

The 24 acres of grass meant for grazing but cut for hay, at Highfield has been ommited from this figure.

No allowance has been made for grazing after hay or silage.

When allowance is made for grazing the figures are:

Grass mainly for silage 246 acres

Total S.E.	722,005 lb.
S.E. per acre	2,935 lb.

Grass mainly for hay as above. The 24 acre

field not included in above figures was the only one grazed after hay.

Output per acre from all crops for winter keep on each farm (both years).

It is felt that while sugar beet tops are of importance as a source of winter feeding they do not affect the growing of silage as opposed to roots directly and it is therefore decided to give the output per acre for winter keep including and excluding sugar beet tops. Another point to bear in mind is that sugar beet is not principally a fodder crop.

Yield per acre from all crops for winter keep (both years)

Farm	Acreage of crops including sugar beet tops	Total S.E. lb.	S.E. per acre lb.	Acreage of crops excluding sugar beet tops	Total S.E. lb.	S.E. per acre lb.
Highfield	178	462,583	2,599	123	349,372	2,840
Congalton	126	348,881	2,769	89	269,231	3,025
*W. Fortune	177	395,224	2,233	133	307,374	2,311
‡Bonnington	113	268,623	2,377	113	268,623	2,377

The yield per acre from all crops for winter keep is not much affected by the inclusion of sugar beet tops. There is, however, a slight reduction in the case of the two farms growing swedes.

* The small acreage of roots grown at this farm has not been included as it is felt that it would obscure the position without giving any extra information.

‡ There is no sugar beet crop on this farm.

Yield per acre from all crops for winter keep excluding sugar beet tops

Figures for both years grouped for farms predominantly roots and farms predominantly silage.

No allowance made for grazing

Farm	Acreage of crops	Total S.E. lb.	S.E. per acre lb.
Roots			
Highfield & Congalton	198	587,947	2,969
Silage			
W. Fortune & Bonnington	246	575,997	2,341

Allowance made for grazing

Farm	Acreage of crops	Total S.E. lb.	S.E. per acre lb.
Roots			
Highfield & Congalton	198	587,947	2,969
Silage			
W. Fortune & Bonnington	246	722,005	2,935

The difference in output per acre is quite large when only winter keep is considered. This difference in favour of farms using roots is very much reduced when credit is given for summer keep (grazing) on land which has been used for silage.

Measurement of S.E. utilised by cattle during winter period.

The S.E. utilised by the cattle during the winter period was calculated by giving an allowance for maintenance and an allowance for liveweight gain. Maintenance was based on the average weight for the period in courts. The average weight was taken to be the weight from grass plus half the weight gained before slaughter or being put out to grass again.

The starch equivalent alloted for gain was based on the liveweight gain over the period in courts and in accordance with the age and condition of the animals. The figures for maintenance and pounds starch equivalent per pound live weight gain are as given by Woodman (1952).

S.E. utilised by cattle in courts winter 1956-57

(details appendix Cattle in Courts 1956-57)

Highfield

There were no complications on this farm as it was possible to weigh all the cattle the day after they came off the grass and all this group were sold fat. The live weight at slaughter was given on the market returns.

On average this large group of 147 mixed black bullocks gained 1.5 cwt. over a fattening period of 168 days i.e. 1 lb. per day.

A group of 22 bullocks was wintered for a short period in the spring and it was possible to weigh them at the mid-point of this period. The average daily gain for this small group had to be estimated.

S.E. utilised by large group for maintenance	126,918	lb.
S.E. utilised by large group for gain	71,652	
S.E. utilised by small group for maintenance	8,894	
S.E. utilised by small group for gain	5,294	
S.E. utilised by all cattle	212,758	lb.

Bonnington

All cattle were weighed into courts and their weight out of courts was given by market returns and weighing those left to go to grass.

A group of 30 mature Friesian bullocks gained on average 2.2 cwt. over a fattening period of 163 days, i.e. 1.61b. per day.

A younger group of 51 Friesian bullocks gained on average 0.5 cwt. over a period of 126 days, i.e. 0.5 lb. per day. (This group had suffered from stomach worms and were in poor condition.)

S.E. utilised by mature group for maintenance	31,745	lb.
S.E. utilised by mature group for gain	22,512	
S.E. utilised by younger group for maintenance	35,811	
S.E. utilised by younger group for gain	5,655	
S.E. utilised by all cattle	95,724	lb.

Congalton

Unfortunately it was not possible to weigh these cattle at the time they were put into courts. The weights were estimated on the basis of the condition of the cattle and their weight when they were put to grass in the spring. All the mature cattle were sold fat and the liveweight at slaughter was found from the deadweight returns and the average killing-out percentage given.

The S.E. utilised by a group of suckled calves was calculated on the estimated average weight for the period and the estimated gain per day.

On average the 60 mature bullocks made an estimated gain of 2.4 cwt. over a fattening period of 182 days i.e. 1.7 lb. per day.

40 suckled calves were wintered for 166 days.

S.E. utilised by mature cattle for maintenance	86,204 lb.
S.E. utilised by mature cattle for gain	59,051
S.E. utilised by calves	38,512
S.E. utilised by all cattle	183,767

West Fortune

The position here was exactly the same as at Congalton and estimations were made in the same way.

On average a group of 78 Irish bullocks made an estimated gain of 2.17 cwts over a fattening period of 148 days i.e. 1.7 per day.

56 suckled calves were wintered for a period of 134 days.

16 stirks were wintered for a period of 134 days.

S.E. utilised by mature cattle for maintenance	65,138 lb.
S.E. utilised by mature cattle for gain	56,828
S.E. utilised by calves	44,300
S.E. utilised by stirks	21,288
S.E. utilised by all cattle	178,554 lb.

There is little doubt that the comparatively low daily live weight gain at Highfield is due to two factors. The cattle were more mature than the others when they were put into the courts and they were much finer boned animals not having the frame to reach such high weights as the heavier boned cattle on the other three farms.

S.E. utilised by cattle in courts winter 1957-58

(Details apprendix Cattle in courts 1957-58)

Highfield

A total of 137 bullocks were taken into the courts and all were sold fat from the courts.

All except 22 home-bred bullocks were Irish stores but they were of the finer type of Irish cattle. The bullocks were weighed into the courts and weights at slaughter were obtained from market returns.

Two groups, each of 50 store bullocks, were bought in the spring for summer grazing but were fed in courts for a short time. The weights and gain by these groups had to be estimated.

On average the 137 gained 1.3 cwt. over a fattening period of 155 days, i.e. 1 lb. per day.

S.E. utilised by the 137 cattle for maintenance	137,982 lb.
S.E. utilised by the 137 cattle for gain	53,758
S.E. utilised by first group of stores	29,838
S.E. utilised by second group of stores	22,400
S.E. utilised by all cattle	243,978 lb.

Bonnington

All cattle were weighed into courts and the weights out of the courts were obtained by market returns and weighing of those left to go to grass.

On average a group of 21 mature Friesian bullocks gained 2.25 cwt. over a fattening period of 164 days, i.e. 1.85 lb. per day.

A group of 56 younger Friesian bullocks gained on average 1.25 cwt. over a period of 179 days i.e. 0.7 lb. per day. (This group were in much better condition than in the previous winter)

S.E. utilised by mature bullocks for maintenance	22,399 lb.
S.E. utilised by mature bullocks for gain	19,152
S.E. utilised by younger bullocks for maintenance	42,633
S.E. utilised by younger bullocks for gain	15,456
S.E. utilised by all cattle	99,640

Congalton

All fattening cattle were weighed into courts and all were sold fat out of the courts. The live weight at slaughter was calculated on the dead weight and the average killing-out percentage given. 92 bullocks were taken into courts in the autumn and of these 64 were mature animals but 28 had still a little growth to come.

On average this mixed group gained 2.8 cwt. over a fattening period of 157 days i.e. 2.0 lb. per day.

40 suckled calves were wintered for 158 days and the S.E. utilised by this group was based on the estimated average weight for the period and the estimated liveweight gain per day.

S.E. utilised by the 92 bullocks for maintenance	91,156 lb.
S.E. utilised by the 92 bullocks for gain	56,281
S.E. utilised by suckled calves	38,236
S.E. utilised by all cattle	186,673 lb.

West Fortune

The position here was the same as at Congalton and calculations were made on the same basis.

98 rather mature Irish cattle were bought into courts and gained on average 1.3 cwt. over a fattening period of 138 days, i.e. 1.1 lb. per day.

80 suckled calves were wintered for a period of 171 days.

S.E. utilised by mature cattle for maintenance	84,546 lb.
S.E. utilised by mature cattle for gain	40,068
S.E. utilised by suckled calves	82,774
S.E. utilised by all cattle	207,388 lb.

It is thought that the comparatively low rate of live weight gain by the 98 cattle at West Fortune was due to their very high condition when put into courts.

Comparison of S.E. fed and S.E. utilised

S.E. fed and utilised 1956-57

Farm	lb. S.E. fed	lb. S.E. utilised	S.E. utilised as % of S.E. fed
Highfield (Swedes)	278,548	212,758	76
Bonnington (Silage)	114,377	95,724	84
Congalton (Swedes)	222,299	183,767	83
W. Fortune (Silage)	234,402	187,554	80

S.E. fed and utilised 1957-58

Farm	lb. S.E. fed	lb. S.E. utilised	S.E. utilised as % of S.E. fed
Highfield (Swedes)	295,296	248,978	84
Bonnington (Silage)	121,660	99,640	82
Congalton (Swedes)	215,669	186,673	87
W. Fortune (Silage)	242,208	207,388	86

It must be remembered that no allowance has been made for straw eaten and that the utilisation of S.E. fed will therefore not be as high as these figures would indicate.

The average utilisation of S.E. fed in 1956-57 is 80% and in 1957-58 85%.

The range in utilisation is amazingly small when one considered such factors as competition and overfeeding. The figure which seems most out of line is that of 76% for Highfield in 1956-57. Considerable thought was given to this but no explanatory factor could be found.

The difference between the farms using swedes and those predominantly silage is not great.

The utilisation is slightly higher on those using silage in the first year and in favour of the two using swedes in the second year. These differences are considered to be due to error, overfeeding, and the effect of competition leading to over and underfeeding in one group.

At all farms the cattle were fed together in groups, ranging from 12 to 56 in one group at Bonnington. This latter group however had free access to feed.

Survey of a larger number of farms

During the winter of 1956-57 a survey was made of a larger number of farms to see how the four chosen fitted into the general pattern.

It had been hoped to cover practically all the farms in the county feeding beef cattle, and records were in fact taken on most of these farms, but a number had to be discarded for various reasons of which the following are a few.

In some cases the larger turnips for cattle were carted off and sheep folded over the same ground. This made it practically impossible to estimate from the field the roots fed to cattle.

Quite large quantities of brock potatoes (chats) were fed from potatoes being dressed on the farm. It was very difficult with a large number of farms to estimate what weight of brock was fed.

Some cattle were fed partly on grass but given some silage or roots. The roots and silage were varied in quantity according to the weather.

The acreages of a field of swedes used for sheep and for carting to cattle was often not known.

In view of these difficulties it was decided to collect the following data from four farms using mainly silage and ten farms using mainly swedes for winter keep.

Acreage of silage and/or roots

Acreage of hay

Acreage of sugar beet tops fed

Concentrates fed

Period of wintering in courts

Numbers and classes of stock wintered.

Survey of fourteen farms surveyed (Details page 109)

Farm Number	Acreage of Crop			Utilised S.E. from silage	Utilised S.E. per acre from silage
	Hay	Silage	Sugar beet tops	lb.	lb.
1	0	37	25	72,072	1,949
2	15	29	0	92,314	3,183
3	20	21	19	45,454	2,164
4	10	27	0	67,502	2,500
Total	45	114	44	277,342	2,433
	Hay	Roots	Sugar beet tops	From swedes	From swedes
5	12	15	0	61,214	4,081
6	12	26	0	86,316	3,320
7	20	20	20	88,460	4,423
8	35	27	0	95,060	3,521
9	21	22	21	76,636	3,483
10	18	27	18	109,490	4,055
11	55	51	0	221,698	4,347
12	28	30	0	106,296	3,543
13	15	23	0	92,726	4,031
14	29	25	0	103,826	4,153
Totals	245	266	59	1,041,722	3,916

Average S.E. per acre from silage utilised on average 2,433 lb.
Average S.E. per acre from roots utilised on average 3,916 lb.

Total S.E. utilised from 45 acres hay and 114 acres silage, on the first four farms, is 331,342 lb. from the 159 acres or 2,084 lb. per acre.

Total S.E. utilised from 245 acres hay and 266 acres roots, on the ten farms using roots is 1,328,522 lb. from 511 acres or 2,600 lb. per acre. It will be noted that the acreage of hay is approx. the same as that of roots where roots are grown but is less than half the acreage of silage where silage is taken.

This latter point is possibly the most important one emerging from this survey and it is based on accurate information without any assumptions being made in the calculation.

The amount and accuracy of information obtained from this survey was not considered to warrant its repetition the following year.

Discussion of Results

It would seem appropriate to think again of the purpose of this work and to discuss the results to see how far they answer or fail to answer the objective and to follow this by any unforeseen points which have arisen.

The objective was summed up in the question - Does the replacement of roots by grass silage increase or decrease the acreage required for a given amount of winter keep and what other factors are of importance in determining the acreage required?

Swedes v Silage

In the first year of the trial (1956-57) there were 133 acres of grass for silage and 49 acres of swedes on the four farms considered. Part of the 133 acres was also cut for hay and the value of the hay is added to that from the silage in the following figures.

Grass mainly for silage	133	acres gave 251,914 lb. S.E. or 1,894lb. per acre
Swedes	49	acres gave 225,857 lb. S.E. or 4,609 lb. per acre

It would seem obvious from these figures that the replacement of swedes by silage was at least cutting in half the output of S.E. per acre.

The same set of results for the following year are:

Grass mainly for silage	113 acres	gave 324,085 lb. S.E. or 2,868 lb. per acre
Swedes	48 acres	gave 191,781 lb. S.E. or 3,994 lb. per acre

In this second year the difference in output per acre between the two crops is much less marked but is still very considerable.

A very noticeable point is that the yield from silage was higher in the second year than the first while the yield of swedes fell. Swedes did not, however, vary as much as silage. The yield of swedes at Congalton on the first year of the trial was from a crop which was generally accepted by all who saw it to be unusually good and this is considered to be the reason for the fall in the second year. At Highfield the output per acre from swedes was very similar in the two year.

When both yeams are combined we get the follow-:ing results:

Grass mainly for silage	246 acres	gave 575,997 lb. S.E. or 2,341 lb. per acre
Swedes	97 acres	gave 417,648 lb. S.E. or 4,305 lb. per acre.

It will be seen that roots have given almost twice the output per acre over the two years and

that they have yielded more consistently than silage.

All the above points are very strongly to the advantage of growing swedes but some other aspects have to be considered.

When credit is given for the grazing of grass after silage the output from the 246 acres is 722,005 lb. S.E. or 2,935 lb. per acre.

Against the variations in yield from silage it must be remembered that it can be kept for several years while swedes have to be consumed before the following year.

Even when these considerations are taken into account it would appear from above that the change to silage would increase the acreage required for winter keep.

Sugar beet tops

Sugar beet tops gave a very constant yield and from the 136 acres grown in the two years 280,711 lb. S.E. or 2,064 lb. per acre were harvested from this crop. This is approaching the yield of winter keep from silage and approximately half the yield from swedes and, as can be seen from the right hand column on pages 30 and 33, they provide a considerable percentage (18% approx.) of the winter keep on the three farms where they are grown.

Hay

The final major component of the winter keep is hay and it is on this factor that much of the discussion will resolve.

For the first year of the trial (1956-57) 80 acres of hay yielded 98,235 lb. S.E. or 1,228 lb. per acre this figure being increased to 1,341 lb. per acre when allowance was made for grazing after the hay.

Corresponding results from the second year were 45 acres, 102,721, 2,283 and 2,283 lb. S.E. respectively.

In giving the average for the two years 24 acres of grass not really intended for hay are omitted and the 101 remaining acres gave 170,299 lb. S.E. or 1,685 lb. per acre. No correction is required for grazing as only the 24 acre omitted from this figure were grazed after hay.

The yield per acre from hay, like that from silage, is much higher in the second year than the first. This factor is considered to be due to low rainfall during the growing period in 1956 as shown by figures on page 36.

Consideration of all crops for winter keep.

It is immediately obvious that in the two years concerned, the yield per acre from hay is considerably lower than that from any of the

other main crops for winter feed. From this it would seem that the more land devoted to hay the more would the average yield from acres for winter keep be depressed.

It was decided to compare the four farms on the output per acre from all crops for winter keep. As sugar beet is not only or even primarily for winter keep the output was calculated including and excluding this crop.

The results for each farm are given on page 38 and for roots and silage farms grouped, including and excluding grazing, on page 39.

It so happens that sugar beet gives approx-imately the average yield for acres devoted to winter keep and thus its inclusion has very little effect on the over-all output per acre. The output per acre from the two farms using silage is the same if allowance is made for error and the small difference between the two using swedes is not considered to be significant.

The two farms growing swedes had an average yield of 2,969 lb. S.E. per acre from all crops for winter keep excluding sugar beet while the corresponding figure for the other two farms was 2,341 lb. S.E. per acre. As explained at the outset this whole work was done on farms and is not very suitable for statistical analysis as the

sample is small, but with the exceedingly small variation between Highfield and Congalton (both roots) and West Fortune and Bonnington (both silage) it is thought that the difference between silage and root farms in output per acre from all forage crops for winter keep is significant.

When allowance is made for grazing, however, the figures become swede farms 2,969 lb. S.E. per acre silage farms 2,935 lb. S.E. per acre. This difference is considered to be well within the limits of experimental error.

Survey or larger number of farms

A survey was carried out on four farms using silage and ten farms using swedes. The accuracy of this survey may not be very great and many assumptions were made in arriving at the final figures for output per acre. They are estimated on a different basis from the four farms studied in detail and are not therefore directly comparable. None the less the relative yield from hay and roots and hay and silage of 2,600 and 2,084 lb. S.E. per acre are very similar to the corresponding figures of 2,969 and 2,341 lb. S.E. per acre on the four trial farms. It must be remembered that the former figures are for utilised S.E. and the latter for S.E. provided. An important factor emerging

from the survey, and one found without any assumptions, was that farms growing roots usually had a very similar acreage under hay while farms growing silage had on average only about half the silage acreage for hay.

Further consideration of Hay

It is this proportionately larger acreage of hay grown on farms with swedes which largely offsets the bigger yield per acre from swedes in comparison with silage.

It is felt that the yield from hay ground could be greatly increased by higher applications of fertilisers, particularly nitrogen. There are however two reasons for not applying more fertiliser. The first is that a very heavy crop of hay goes down, is difficult to cut and is soft and difficult to make. The second is that the hay crop is often considered as a rest for heavily cropped land and there is no attempt to take the potential yield.

Other factors which cause a low yield from hay are spoilage by weather, which makes a considerable amount of hay unusable, and a second cut is often not taken so that the land can be ploughed early. The growth which could be giving a considerable yield of second crop hay may be left and ploughed in later as green manure.

Many of these practices can be justified on an economic or husbandry basis. This complicates the issue as one cannot measure green manuring on a direct S.E. per acre basis.

Effect of Roots v Silage on general fertility

From above arises the point as to whether silage or roots has the more beneficial effect on the following crop and general fertility of the farm as a whole. This is difficult to ascertain as roots are generally followed by barley and silage is often followed by potatoes. It was found, however, on the four trial farms where the present systems have been working for several rotations, that the average yield of barley at 16% moisture was within plus or minus one hundredweight of two tons on each of the four farms in the year 1956. No true comparison was possible the following year as some of the farms suffered more than the others from very considerable loss by wind blowing off the ripe barley heads.

The potato crop was considered as a criterion of level of fertility but the yield was so radically changed by the time of lifting of earlies and the incidence of blight in the maincrop that the figures are not considered useful for this purpose.

The yields on the three farms where potatoes were grown were high except where Epicure potatoes were lifted very early or King Edward potatoes were severely affected by blight.

All that can be said is that no difference in the effect of silage as opposed to roots on the general level of fertility has been demonstrated by this experiment. It is felt, however, that a study of comparable farms over a period of at least ten years would be necessary to detect any effect on general fertility. This view is based on the fact that several farms in the area have been very heavily white cropped for a number of years, after having been traditionally farmed with adequate root breaks, grass and farm yard manure, and it is only after several years that yields have fallen off.

Utilisation of S.E. fed

All the foregoing discussion is based on the results from the direct measurement of crops, of total yield and of S.E. of the crop as harvested. When consideration is given to the utilisation of the feed provided under farm conditions we have to decide whether or not all feeds given were equally well utilised.

In all cases the animals were fed to appetite and it is felt that loss in utilisation

would be almost entirely due to the passage of food through the gut at a higher rate than that at which complete digestion could take place. It was therefore decided to assume that all feeding would be equally well utilised.

When allowance is made for overfeeding and other practical considerations the differences in utilisation between the different farms are small. This would indicate that the direct measurement of the fodder had been quite accurate. There is, however, the chance that some errors may have cnacelled each other out but this does not seem to be the case in general. At Bonnington where no sugar beet tops and very little hay have been fed the utilisation is very similar to the other farms, including West Fortune where a similar ration is fed plus sugar beet tops. The differences in utilisation of feed between farms using swedes and those using silage is also small and not considered significant. There is a difference in utilisation between the two years of 5% but there is no apparent reason for this and it is attributed to variations in feeding or error in measurement.

The over all utilisation of 82% is about what might be expected under the prevailing conditions.

In general it may be said that the measurement of S.E. utilised tended to confirm the results by direct measurement or at least did not demonstrate any wide inaccuracy in them.

It must be remembered that no allowance is made for straw and that the utilisation will not therefore be as high as indicated. It is also thought that the cattle on swedes would consume rather more straw, due to the high moisture content of swedes, but there was no method of measuring straw eaten. As straw was very plentiful the amount eaten as opposed to bedding is not of practical importance in this area.

Effect of Roots v Silage on Liveweight Gain

The cattle wintered on the four farms were of different breeding and stages of maturity and these factors far outweighed any differences there may have been between silage, roots and sugar beet tops in their effect on liveweight gain per day.

Summer Grazing

The summer grazing is not very closely related to the question of winter keep. Occasionally a field was grazed after silage but no fields were set up for silage and grazing. It would seem that a better output might be possible if the two were more closely combined and each field of rotation

grass cut at least once for silage and grazed in the same year. This is of course looking at it only from the output per acre and there are other considerations such as fencing and provision of water. On beef farms in the area at present silage is regarded as a crop with grazing as a secondary consideration and the two are not integrated. With dairy farms however the two are worked together more closely. Those observations also apply to some extent to the hay crop.

Relative importance of crops for winter keep

It is of interest to note the relative importance of the various crops in the winter ration. The right hand column on pages 30 and 33 gives the percentage of winter keep provided by each crop. It will be noticed that roots provided about 40% of the ration at Highfield and Congalton. At Bonnington, where there is no sugar beet, silage constitutes about 95% of the winter keep. Silage and the small amount of roots at West Fortune make up 53% of the ration. There is some variation in the proportion of the ration constituted by hay at Congalton in the two years but on average it will be seen that both the roots farms rely considerably more on hay than West Fortune and at Bonnington the amount of hay fed is exceedingly small. There figures are as would be

expected from the trend of growing less acres of hay with silage than with roots.

The amount of concentrates fed varies between 14.5 and 23 per cent with the exception of Bonnington where very little is fed. It is unlikely that the quantities of cereals and sugar beet pulp, fed on the other farms, would be as high were it not for the fact that the cereal screenings are of little sale value and sugar beet pulp is sold back to growers at a very reasonable price.

Dry Matter of Swedes

It was of interest to note that as found by Anon (1906-7) and numerous others, the dry matter of the swedes tended to fall as the yield per acre increased. The dry matter was 10% with a yield of 600 cwt. per acre and fell to 8% with a yield of 840 cwt. per acre.

Dry Matter of Silage

As with swedes the dry matter of the silage, on which the S.E. largely depends, was highest where the yield per acre was lowest.

With both silage and swedes however the higher dry matter of lower yields was not sufficient to raise the S.E. per acre to the level of the higher gross yields.

General Discussion and Observations

Sugar Beet Tops

It was noticed that even with the most efficient tops savers that at least one quarter of the tops of sugar beet were left in the field. This may not be of great importance but it is mentioned to avoid error in taking the weight of tops given as being the actual weight in the field. The yield of tops to roots is possibly higher in this area than in England, being at least one to one.

Realisation of Potential Yield

In watching the harvesting and methods of growing swedes on the two farms concerned there seemed no way of improving the yield by changing the manuring or methods of cultivation and harvesting of the crop. It is not the practice in this area to save the tops of swedes and there is little doubt that some increase in feeding from an acre could be obtained if this was done. The lifting of the tops would require extra labour however and the yield would not be high except early in the autumn before they die down. Sheep are sometimes allowed to eat the tops in the field but often they are ploughed in. This ploughing in of tops will of course have some manurial value.

With silage it was felt that an increased yield could be gained by cutting three times or combining silage making and grazing more closely. It was also felt that a third application of nitrogen might have been worth while. This is looking at the problem from the standpoint of output per acre. It is realised that the cost of extra manures and the cost of an extra cut would need to be considered but it is felt they might prove well worth while, especially at Bonnington where the grass is followed by grain. At West Fortune where potatoes follow silage there is a stronger argument for ploughing in green manure.

The introduction of forage harvesters will increase the possibility of cutting three times. The output of these machines in terms of tons per hour is fairly constant in light and heavy crops and the acreage covered is relatively unimportant when compared with the reaper. This factor makes it economic to take a cut from a field even if the yield per acre is quite low.

Comparison with Grass Drying

It is interesting to note that a grass drier in the area harvested 4.1 tons of dried grass per acre in 1956 and 4.25 tons per acre in 1957. The area involved was approximately 250 acres each year.

This grass however was Cocksfoot (Dactylis Glomerata) S.143 and was semi-permanent pasture. The manuring was 80 lb. of K_2O and 225 lb. of nitrogen per acre applied in small amounts throughout the growing season, and three to four cuts were taken.

This system is not directly comparable with conditions for silage making but it is interesting to note that, allowing a S.E. of 60 for this grass meal, the output per acre was 5,510 lb. S.E. in 1956 and 5,712 lb. S.E. in 1957. Even when allowance is made for the different conditions and the lower loss of nutrients in grass drying as compared with silage making it is felt that more intensive management of grass for silage could narrow the gap in yield between the two systems of grass preservation. The fields with grass for drying grazed sheep for a considerable period of the winters 1955-56 and 1956-57.

Necessity for feeding hay

Most farmers feeding roots seem to feel that a fairly large amount of hay in the ration is necessary especially in the final stages of fattening. At Congalton, however, in the winter 1956-57 only 11% of the ration was comprised of hay. These cattle made satisfactory liveweight gain and were reported by the Fat Stock Marketing Corporation to have graded well.

It would seem that the acreage of hay is kept at its present level mainly for its value for green manuring as well as a producer of winter keep. If rotations were more strictly adhered to it would be possible to discuss how the acreages of the fodder crops might fit into a rotation but under present practice this is not practicable.

Effect of intensive manuring and cutting of grass on following crops

There is a general feeling that if grass is heavily manured and cut two or three times during the summer that the field will not be left in as high a state of fertility as where less intensively handled.

This factor would be worthy of a study on its own and it is not intended to discuss it at great length here. Observations however do not always bear this out and the land after being very intensively manured and cut for grass drying for six to seven years is so strong when ploughed that only wheat will not lodge very badly on it. Unless grass is reasonably well manured the root development, from which much of the humus is derived, will not reach its potential. There is little doubt however that ploughing in foggage instead of cutting and carting it off will help the fertility.

CONCLUSIONS

Conclusions based on four farms studied in detail

1. Under the present system of manuring and harvesting the output per acre from roots is much higher than that from silage. On average over the two years roots yielded 4,305 lb. S.E. per acre and silage 2,341 lb. S.E. per acre. If allowance is made for grazing after silage the figure becomes 2,935 lb. S.E. per acre.

2. The output per acre from roots appears to be near its potential but that from silage could be increased by more liberal manuring and the taking of a third cut.

3. The output per acre from all fodder crops, taken together, is similar on the four farms if allowance is made for grazing after silage and slightly in favour of the farms growing swedes if grazing is not considered.

4. The yield of S.E. per acre from hay is considerably lower than that from any other fodder crop.

5. This low return from hay coupled with the relatively large acreage grown on the two farms with swedes largely offsets the high output per acre from the swedes.

6. Taking a crop of hay is looked upon by farmers not merely as providing winter keep but as a method

of resting land and often of green manuring by ploughing in a long foggage.

7. Sugar beet tops form an important part of the ration where this crop is grown and yield half as much S.E. per acre as a crop of swedes.

8. No difference in general fertility between the farms has been demonstrated.

9. Young and mature cattle seemed to thrive equally well on rations based on silage and rations based on roots but no close comparison was possible because of the different breeds and condition of cattle brought in for wintering on the four farms.

10. The overall utilisation of winter feed was 82% when no allowance was made for straw and no difference in utilisation between the fodders, hay, silage, sugar beet tops and roots was demonstrated.

11. Utilisation of grass, extensively grazed during the summer of 1956, ranged from 1,465 to 2,445 lb. S.E. per acre.

Conclusion based on survey of larger number of farms

12. Farms in the county growing swedes have a similar acreage under swedes and hay while farms growing silage have on average only half the silage acreage under hay.

Observations

1. It is felt that if silage making and grazing were more closely integrated that the overall production from grass would be higher.

2. The question of whether it is necessary to take such a small return from the hay ground in the interest of general fertility of the land is thought to be worthy of a study on its own. In this connection more grazing of hay ground could be considered.

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GRAZING SUMMER 1956

Highfield

58 Home-bred cattle to grass 1st April - 2nd November

215 days 12,470 cow days

Total weight to grass 375.75 cwt.

Average weight 6.48 cwt.

Total weight off grass 480.5 cwt.

Average weight 8.28 cwt.

Average weight for the period 7.4 cwt.

S.E. for maintenance 5.25 lb. per day

∴ Total S.E. for maintenance 65,467 lb. S.E.

S.E. per lb. gain 2.5 lb.

S.E. for gain 104.75 x 2.5 x 112 lb. = 29,335 lb.

∴ Total S.E. utilised 94,802 lb.

Two thirds of the time for one month spent on 24 acres after hay

Estimated S.E. from this field 9,024 lb.

= 376 lb. per acre

Also grazed 41 acres of permanent pasture

∴ S.E. from permanent pasture 85,778 lb.

= 2,092 lb. per acre

Average gain per head 1.8 cwt.

" " " day 1.0 lb.

Average No. of days grazed 215

28 Irish cattle to grass 16th May

28	grazed to	9th August	2,352	cow days
1	"	" 20th August	11	" "
20	"	" 16th October	1,360	" "
16	"	" 25th October	144	" "
			3,867	" "

Total weight to grass 199.875 cwt.

Average weight 7.1 cwt. Range 6.5 - 8.5 cwt.

Total weight off grass 261.875 cwt.

Average weight 9.31 cwt. Range 8.5 - 11.25 cwt.

Average weight for period 8.2 cwt.

S.E. for maintenance 5.5 lb. per day

∴ Total S.E. for maintenance 21,269 lb.

S.E. per lb. gain 2.5

S.E. for gain 2.5 x 112 x 62 = 15,400 lb.

∴ Total S.E. utilised 36,669 lb.

Grazing 15 acres

Yield per acre 2,445 lb.

Average gain per head 2.2 cwt.

Average gain per day 1.7 lb.

Average No. of days grazed 138

Group of 10 Irish cattle to grass 14th May - 25th October

163 days 1630 cow days

Total weight to grass 76.625 cwt.

Average weight 7.66 cwt. Range 7.25 - 8.5 cwt.

Total weight off grass 98.375 cwt.

Average weight 9.84 cwt. Range 9.5 - 10.75 cwt.

Average weight for period 8.25 cwt.

S.E. for maintenance 5.125 lb. per day

∴ Total S.E. for maintenance 5.125 x 1630 = 8,354 lb.

7 cattle grazed 9th August - 25th October

77 days 539 cow days

Weight to grass (estimated) 8.1 cwt.

Weight off grass (actual) 9.1 cwt.

Average weight for the period 8.6 cwt.

S.E. for maintenance 6.1 lb. per day

Total S.E. for maintenance 539 x 6.1 = 3,234 lb.

Gain for 10 cattle 21.75 cwt.

Gain for 7 cattle 7 cwt. (estimated)

Total gain 28.75 cwt.

S.E. for gain 28.75 x 112 x 2.5 = 8,330 lb.

∴ Total S.E. utilised 19,918 lb.

Grazing 12 acres

Yield per acre 1,660 lb.

Average gain per head 2.2 cwt.
Average gain per day 1.5 lb.

Bonnington

45 Fresian cattle to grass 30th March

5 grazed to 15th October 995 cow days

10 " " 17th October 2,010 cow days

30 " " 7th November 6,660 cow days

9,665 cow days

Total weight to grass 265 cwt.

Average weight 5.8 cwt. Range 2.25 - 8 cwt.

Total weight off grass 45.75 cwt.

Average weight 9 cwt. Range 8.25 - 10.5 cwt.

Average weight for period 7.4 cwt.

S.E. for maintenance 5.25 lb. per day

$\therefore$ Total S.E. for maintenance 50,741 lb.

S.E. per lb. gain 2.5 lb.

$\therefore$ S.E. for gain 140.625 x 112 x 2.5

= 39,375 lb.

Total S.E. utilised 90,116 lb.

Grazing 38 acres

Yield per acre 2,372 lb. S.E.

Average gain per head 3.2 cwt.

Average gain per day 1.6 lb.

Average No. of days grazed 215

53 Fresian calves to grass 30th March - 7th November

222 days 11,766 cow days

Total weight to grass (estimated) 132.5 cwt.

Average weight 2.5 cwt.

Total weight off grass 281 cwt.

Average weight 5.3 cwt. Range 3.5 - 7 cwt.

Average weight for period 3.9 cwt.

S.E. for maintenance 3.5 lb. per day

$\therefore$ Total S.E. for maintenance 41,181 lb.

S.E. per lb. gain 1.65 lb.

. . S.E. for gain 148 x 112 x 1.65 lb. = 27,420 lb.

Total S.E. utilised 68,601 lb.

Grazing 36 acres

Yield per acre 1,906 lb. S.E.

Average gain per head 2.8 cwt.

Average gain per day 1.4 lb.

Average No. of days grazed 222

204 Suffolk lambs grazed for 11 weeks after silage and hay

S.E. required per head per week 12 lb.

Total S.E. utilised by sheep 12 x 11 x 204 = 26,928 lb.

Grazed 66 acres

Yield per acre 408 lb. S.E.

Congalton

51 mixed Irish Cattle to grass 25th April - 16th October

175 days 8,925 cow days

Total weight to grass 363.25 cwt.

Average weight 7.12 cwt. Range 4.75 - 9.75 cwt.

Total weight off grass (estimated) 465.25 cwt.

Average weight (estimated) 9.12 cwt.

Average weight for the period 8.1 cwt.

S.E. for maintenance 5.5 lb. per day

∴ Total S.E. for maintenance 49,088 lb.

S.E. per lb. gain 2.5 lb.

S.E. for gain 102 x 112 x 2.5 = 28,560 lb.

∴ Total S.E. utilised 77,648 lb.

Grazing 53 acres

Yield per acre 1,465 lb. S.E.

Average gain per head 2.0 cwt.

Average gain per day 1.3 lb.

Average No. of days grazed 175

West Fortune

78 Mixed Irish Cattle to grass 30th March - 1st November

215 days 16,770 cow days

Total weight to grass 525.5 cwt.

Average weight 6.74 cwt. Range 5.75 - 8.25 cwt.

Total weight off grass (estimated) 665.5 cwt.

Average weight 8.54 cwt.

Average weight for the period 7.64 cwt.

S.E. for maintenance 5.25 lb. per day

∴ Total S.E. for maintenance 88,043 lb.

S.E. per lb. gain 2.5 lb.

S.E. for gain 112 x 1.8 x 78 x 2.5 = 39,312 lb.

∴ Total S.E. utilised 127,355 lb.

Time spent on 40 acres after hay and silage 40 days

∴ S.E. from this 23,694 lb = 592 lb. per acre

∴ S.E. from other 58 acres 103,661 lb. = 1,787 lb. per acre

Average gain per head 1.8 cwt.

Average gain per day 1.0 lb.

Average No. of days grazed 215

WINTER KEEP 1956-57 DIRECT MEASUREMENT

Highfield

Swedes 25 acres

Area taken $8 \times \frac{26}{12} \times 4 \times \frac{1}{9}$ square yards

This gives 67,350 ±2,000 lb. per acre (30 tons approx.)

Dry Matter 10.0% ∴ S.E. = 6.3

∴ from 25 acres 106,076 lb. S.E.

	lbs.
Actual weight	111
	102
	104
	114
	112
	100
	6/643
Mean	107.2

Sugar beet Tops 25 acres

Area taken $10 \times \frac{26}{36}$ square yards

This gives 23,656 ±1,100 lb./acre (10 ton approx.)

Dry Matter 15.1 ∴ S.E. = 8.0

∴ from 25 acres 47,312 lb. S.E.

	lbs.
Actual weight	36
	33
	37
	37
	34
	35
	6/212
Mean	35.3

Hay 58 acres

Weight of each bale 67.7 ±2 lb.

Number of bales 3,127 = 211,698 lb.

(95 ton approx. or 31 cwt. per acre approx.)

S.E. = 35 ∴ 74,088 lb. S.E.

Weight of bales
70
66
66
66
68
70
6/406
Mean 67.7

From grazing of hay ground 9,025 lb. S.E.

∴ Return from hay ground 83,113 lb. S.E.

∴ Total S.E. from roughages for winter keep 227,476 lb.

19 ton sugar beet pulp S.E. 60 25,536 lb. S.E.

19 ton Barley lights S.E. 60 25,536 lb. S.E.

∴ Total S.E. fed to cattle 278,548 lb. S.E.

Bonnington

Silage 1st Cut 66 acres

L B H

Pit dimensions 63 x 39.25 x 3.82 cubic feet

Length and breadth by direct measurement

Height mean of 10 measurements

Capacity is therefore 9,446 cubic feet

Density found to be very constant by direct measurement was 45.2 lb. per cubic feet

∴ weight of silage 426,959 lb. (190 tons approx.)

S.E. of silage 11.5

∴ S.E. from this first cut = 49,100 lb.

3 tons per acre approx.

Less 51 ton = 13,138 lb. S.E. to calves

= 35,962 to Weighed Cattle

Height ft.	ins.
0	0
2	6
5	3
5	7
6	5
6	3
5	9
4	2
2	3
0	0
38	2

Silage 2nd Cut 48 acres

L B H

Pit dimensions 70.5 x 46 x 4.16 cubic feet

Capacity 13,491 cubic feet

Density 42.0 lb. per cubic foot

∴ weight of silage 566,622 lb. (250 tons approx.)

S.E. of silage 12.5

∴ S.E. of second cut = 70,828 lb.

5 tons per acre approx.

Height ft.	ins.
0	0
3	8
4	5
5	9
6	9
6	8
6	7
4	4
3	3
0	0
41	5

This represents approximately 4 tons per acre per cwt. all over

∴ Total S.E. of BOTH cuts 119,928 lb.

Less to calves (see below) 13,138 lb. = 106,790 lb.

Hay 18 acres 1 cut 631 bales

∴ Bales weigh 4.15 ±1.9 lb.

∴ Weight of hay 11.69 tons ±(.54 tons)

S.E. of this Hay 30 (15 cwt./acre approx.)

∴ Lb. S.E. from Hay 7,856

Less 4.5 tons to calves 4,832 to Mature cattle

Weight of bales
42 lb.
43
40
41
39
44
6/249
Mean 41.5

Oats

Best removed therefore S.E. estimated at 60

41 cwt. @ S.E. 60 2,755 lb. S.E.

∴ Total S.E	130,539	
Less to calves 4.5 tons Hay @ S.E. 30	3,024	
Less to calves 51 tons silage S.E. 11.5	13,138	
∴ S.E. to the two groups of cattle	114,377	lb.
∴ Total S.E. to large group from roughage	111,622	lb.

Sheep grazed on grass which was primarily to supply silage and hay for winter keep.

204 lambs for 11 weeks

From Bulletin No. 48 this class of sheep require 12 lb. S.E. per week

∴ Total S.E. utilised by these sheep 204 x 11 x 12 =

26,928 lb.

Congalton

Swedes 5 acres

Area taken for each weighing $\frac{26}{36}$ x 9 square yards

This gives 79,823 ±3,500 lb./acre (36tons approx.)

Dry Matter 9.2 S.E. 5.87

∴ from 5 acres 23,428 lb. S.E.

	lbs.
Actual Weight	112
	107
	100
	106
	108
	110
6/	643
Mean	107.2

19 acres

Area taken as above

This gives a yield of 98,662 ±3,000lb./acre (44tons approx)

Dry Matter 8.1 S.E. 5.14

∴ from 19 acres 96,353 lb. S.E.

Total S.E. from roots 119,781lb.

	lbs.
Actual Weight	130
	139
	137
	130
	126
	130
6/	795
Mean	132.5

Sugar beet Tops 17 acres

Area taken for each weighing 2 x 7 yds.

This gives 26,620 ± 1,500 lb./acre (12½ tons approx.)

Dry Matter 16.2 S.E. 8.6

∴ from 17 acres 38,984 lb. S.E.

	lbs.
Actual Weight	74
	79
	75
	78
	85
	71
6/	462
Mean	77

Hay 22 acres

Weight of bales 44.5 ± 2 lb.

Number of bales 1,550 = 68,975 lb. of hay(30 ton app.)

with an S.E. of 35 = 24,147 lb. S.E.

30.8 tons @ S.E. 35 gives 24,147 lb. S.E.

Actual Weight of bales	
	41
	47
	45
	44
	46
	44
6/	267
Mean	44.5

Total from Roughages 182,912 lb.

2 tons Palm Kernal Cake	S.E. 73.2	3279
2 tons Proprietary Cake	S.E. 71	3180
24.5 tons Light Oats and Beet Pulp	S.E. 60	32928
		39387

Total S.E. fed 222,299 lb.

West Fortune

Silage 1st Cut 46 acres

Pit dimensions L B H 90 x 21 x 3.63 cubic feet

Length and breadth by direct measurement

Height average of ten places

Capacity 6,861 cubic feet

Density 45.7 lb.

∴ 313,548 lb. silage (140 tons approx.)

S.E. of silage 15

∴ S.E. from first cut = 47,032 lb.

3 tons per acre approx.

Height ft.	ins.
2	5
3	0
3	7
3	7
4	1
4	8
4	4
4	2
3	5
3	1
36	4

2nd Cut 67 acres

Pit dimensions L B H 90 x 21 x 4.17 cubic feet

Height taken at ten places

Capacity of silage 7,881 cubic feet

Density 41.5 lb. per cubic foot

∴ 327,062 lb. silage (146 tons approx.)

2 ton per acre approx.

S.E. of silage 15

∴ 49,059 lb. S.E. from 2nd Cut

∴ Total S.E. from both cuts 96,091 lb. S.E.

Height ft.	ins.
3	9
4	0
4	0
4	3
5	1
5	6
5	2
3	11
3	6
2	6
41	8

Hay 21 acres

1885 bales @ 42.5 ±2 lb.

∴ weight of hay = 80,112 lb ±3,500 lb.

(36 ton approx. or 35 cwt./acre approx.)

S.E. of this hay 35 = 28,039 lb. S.E. from hay

weight of bales
42 lb.
39
44
45
42
43
6/225
Mean 42.5

Beet Tops

Area taken for each weight $10 \times \frac{26}{36}$ square yards

This gives 27,342 ±900 lb./acre (12.5 ton approx.)

∴ from 24 acres 656,208 lb.

Dry Matter 14.4

∴ estimated S.E. = 7.65

∴ from sugar beet tops 50,200 lb. of S.E.

Actual weight
44 lb.
42
43
38
38
40
6/245
Mean 40.8

Mangolds

Area taken at each weighing $\frac{8}{9} \times \frac{26}{12} \times 4$ square yards

This gives 74,576 ±2,700 lb./acre (32 ton approx.)

for 5 acres 372,880 lb.

Dry Matter 13.1 ∴ S.E. 6.8

∴ From Mangolds 25,356 lb. of S.E.

Actual weight
114 lb.
113
123
122
116
124
6/712
Mean 118.7

Total S.E. from Roots & Roughages

Silage	96,091
Hay	28,039
Sugar Beet Tops	50,200
Mangolds	25,356
	199,686

Concentrates

5 tons Barley Meal	S.E.	71.4	7,997
4 tons Palm Kernal Meal	S.E.	73.2	6,559
15 tons Dried Beet Pulp	S.E.	60.0	20,160
			34,716

∴ Total S.E. fed to Cattle in Courts for winter 1956-57 = 234,402 lb.

WINTER KEEP 1957-58 DIRECT MEASUREMENT

Highfield

Swedes

Area taken 4 x 4 x $\frac{26}{36}$ square yards = $\frac{13}{5445}$ of an acre

This gives 73,371 lb. ±1,2500 lb. per acre (33 tons approx.)

Dry Matter 8.73% .·. S.E.5.54

.·. S.E. from 28 acres 101,609

plus 12,192

113,801 = 4,064 lb. per acre

	lbs.
Actual weight	176
	177
	170
	172
	177
	178
6/1051	
Mean	175.16

Sugar beet Tops 18 acres

Area taken 12 x $\frac{26}{36}$ square yard = 21,982 ±700 lb. per acre

Dry Matter 16.4 .·. S.E. 8.71

.·. S.E. from 18 acres 34,903 lb.

	lbs.
Actual weight	54
	56
	52
	56
	56
	53
6/327	
Mean	54.5

12 acres

Area taken 12 x $\frac{26}{36}$ square yards = 27,626 ±900 lb. per acre

Dry Matter 17.5 .·. S.E. 9.35

.·. S.E. from 12 acres 30,996 lb.

Total from sugar beet 65,899 lb. S.E. or 2,197 lb. S.E. per acre

	lbs.
Actual weight	70
	67
	67
	71
	69
	67
6/411	
Mean	68.5

Hay Rocky field 22 acres

Weight of each bale 70.7 ±2 lb.

Number of bales 2,305 = 162,963 lb. (approx. 70 tons)

With an S.E. of 34 = 55,407 lb. = 2,519 lb./acre

10 acre field 26 tons SOLD

Weight of bales	
	69
	73
	69
	71
	73
	69
6/424	
Mean	70.7

Potatoes	22 tons @ S.E. 18.5	9,117

Concentrates

Beet Pulp	12 tons	S.E. 60	16,128
Barley thin	24 tons	S.E. 60	32, 256
Oats	2 tons	S.E. 60	2.688
			51,072

Total S.E. fed to cattle 295,296

Bonnington

Silage 1st Cut 47 acres

Pit dimensions L B H 93 x 60 x 5.11 cubic feet

Height mean of 10 measurements

Capacity 28,514 cubic feet

Density 38.7 lb. per cubic foot

∴ weight of silage 1,103,484 lb. (500 tons approx.)

S.E. of silage 10.5

∴ S.E. from this first cut 115,916

10.5 ton per acre

Height ft.	ins.
4	7
6	8
6	7
7	3
7 3/8	3
7	3
6	10
4	0
51	1

Silage 2nd Cut 22 acres NOT FED TO WEIGHED CATTLE

Pit dimensions L B H 61 x 23 x 2.91

Capacity 4,083 cubic feet

Density 43.6 lb. per cubic foot

∴ Weight of silage 178,019 lb. (80 tons approx.)

S.E. of silage 14.0 S.E. from second cut = 24,923

3½ ton/acre approx.

This represents approx. 5.5 ton per acre per cut all over.

Height ft.	ins.
0	0
1	3
3	10
4	7
4	9
4	7
4	8
3	11
1	6
	0
29	1

Hay

Off grass mainly for grazing about 8 tons not fed to weighed cattle and not relevent in these calculations. An attempt made to make hay of grass after silage. Potentially about 20 tons but completely ruined and made uneatable by rain.

Oats

9,840 lb. of oats fed (4 tons approx.) S.E. 60

Total S.E. from oats 5,744 lb.

Total S.E. Fed to weighed cattle 121,660 lb.

Cattle grazed on ground mainly for winter from 1957-58

56 calves from 14th August - 24th October when they were 6.44 cwt.

Say calves gained 1 lb. per day Average weight for period 6 cwt.

Cow days 3976

S.E. per day for maintenance 4.5

Total S.E. for maintenance 17,892 lb.

S.E. per lb. gain 1.65

Total S.E. for gain 6,560

Total S.E. utilised by this group 24,452 lb.

31 cattle at 8 cwt. for 31 days 961 cow days

S.E. per day for maintenance 5.5

Total S.E. for maintenance 5,308 lb.

S.E. per lb. gain Say gain 1.5 lb. per day

Total S.E. of gain 2,881

Total S.E. utilised by this group 8,189 lb.

Total S.E. utilised by cattle on grass mainly for winter keep 32,641 lb.

Sheep grazed on ground mainly for winter keep

180 lambs for 11 weeks

Estimated requirement of 12 lb. S.E. per sheep per week

∴ Total S.E. utilised by these sheep 23,760

Congalton

Swedes W. Betry

Area taken $4 \times 4 \times \frac{26}{36}$ square yards

This gives 63,384 ±2,500 lb. per acre

20 acre @ D.M. 9.7 ∴ S.E. 6.16

= 77,989 lb. S.E. 3,900 lb. per acre

Actual Weight	lbs.
	160
	158
	148
	154
	144
	144
6/	908
Mean	151.3

Beet Tops Brownrigg field less 4 acres

Area taken $\frac{26}{36} \times 7$ square yards

This gives 30,348 ±1,500 lb. per acre

Dry Matter 14.5 ∴ S.E. 6.7

∴ from 20 acres 40,666 lb. S.E. = 2,033 lb. per acre

Actual Weight	lbs.
	34
	34
	32
	29
	30
	31
6/	190
Mean	31.7

Hay Long field 23 acres

Weight of bales 43.5 ±2 lb.

Number of bales 3,399 ∴ 147,857 lb. Hay (approx. 68 tons)

S.E. 32

∴ lbs. of S.E. 47,314 lb. S.E.

= 1,883 lb./acre

Actual	Weight of bales
	46
	40
	44
	43
	45
	43
6/	261
Mean	43.5

Concentrates

4 tons Palm Kernal Cube	S.E.	73.2	6,558
32 tons light oats and sugar beet pulp	S.E.	60.0	43,142
			49,700

Total S.E. to cattle 215,669 lb.

West Fortune

Hay 20 acres

Average weight of bale 41.5 lb. ±1 lb.

Number of bales 2589

107,443 lb. of hay (50 cwt. per acre approx.)

S.E. 33 ∴ S.E. from hay 35,456 lb.

Weight of bales in lbs.
44
43
39
39
41
43
6/249
Mean 41.5

Silage 1st cut 28 acres

Pit Dimensions L B H 21 x 90 x 4.92 cubic feet

Capacity 9,299 cubic feet

Density 53.2 lb./cubic foot

∴ 494,707 lb. silage (220 tons approx. or 8 tons/acre approx.)

S.E. of this silage 15.0

Total S.E. from this silage 74,206

Height ft.	ins.
4	3
5	0
5	0
5	3
6	1
6	0
5	8
4	11
4	-
3	-
49	2

Silage 2nd cut 66 acres

Pit Dimensions L B H 21 x 90 x 3.13 cubic feet

Capacity 5,915 cubic feet

Density 35.3 lb./cubic foot (77 tons or 25 cwt. per acre approx.)

208,780 lb. of silage

S.E. 17

∴ Total S.E. from this silage 35,496

Height ft.	ins.
2	4
2	6
3	1
3	4
3	10
3	10
3	8
3	6
2	7
2	7
31	3

∴ Total S.E. from silage 109,702

Beet tops 20 acres

Tops all taken off and heaped in before weighing was possible.

Yield of tops estimated at 95% previous year less extra 5% for loss of feeding during longer time in heaps.

Total S.E. previous year from 24 acres = 50,200 lb.

∴ estimated S.E. from 20 acres this year

$= \frac{20}{24} \times \frac{90}{100} \times 50{,}200$ lb. = 37,650 lb. of S.E.

Swedes

80 tons of swedes grazed from trailer loands off 3 acres of ground

Dry matter 10% S.E. 6.3

∴ Total S.E. from swedes 11,290 lb.

Mangolds

2 acre mangolds estimated yield 27 tons per acre

Dry matter 11.8 ∴ S.E. 6.1

∴ Total S.E. from mangolds 7,378 lb.

Concentrates

7½ tons Barley Meal	S.E. 71.4	11,997
4 tons Palm Kernal Meal	S.E. 73.2	6,559
16½ tons Dried beet Pulp	S.E. 60.0	22,176
		40,732

Total S.E. fed to cattle wintered in courts 1957-58 = 242,208 lb.

Hay SOLD or STILL ON FARM AT END OF WINTER.

18 acres gave 4½ stacks one sold weighed 10 tons 4 cwt = 10.2 tons

∴ weight of hay = 102,816 lb. (46 tons approx.)

Excellent condition S.E. 35

∴ S.E. from this hay 38,086 lb. (yield of hay 50 cwt./acre approx.)

Cattle grazed on ground mainly for hay and silage

80 cattle for 7 weeks = 3920 cow days

At end of the 7 weeks average weight of the cattle was 9.5 cwt. (see

Say gain of 1.3 lb. per day average weight per period = 9.5 cwt. less 32.5 lb. = 9.25 cwt. approx.

S.E. per day for maintenance 6lb.

∴ Total S.E. for maintenance 23,520 lb.

S.E. per lb. gain 2.75 lb.

Total S.E. for gain 1.3 x 2.75 x 3920 = 11,465 lb.

Total S.E. utilised by these cattle 34,985 lb.

CATTLE IN COURTS WINTER 1956-57

Highfield

No. of Cattle	Type	Weight In	Weight Out
58	Homebred Black	480.5 cwt.	562.0 cwt.
21	Irish	157.75 "	218.75 "
1	"	8.5 "	11.0 "
6	"	57.4 "	60.5 "
23	"	213.5 "	223.75 "
38	"	334.13 "	386.0 "
147		1,251.75cwt.	1,462.0 cwt. Total

All cattle in courts 2nd November, 1956.

Cattle out of courts

Date	Number	Cow Days	Date	Number	Cow Days
15/1	4	300	26/3	8	1,160
22/1	8	656	2/4	8	1,216
29/1	8	712	16/4	8	1,328
5/2	8	768	23/4	8	1,384
19/2	8	880	30/4	8	1,440
26/2	10	1,170	7/5	8	1,496
5/3	12	1,488	21/5	9	1,809
12/3	10	1,310	4/6	12	2,580
19/3	8	1,104	Total	145	20,801

Two casualties after 170 and 182 days = 352 cow days

∴ Total number of cow days 21,153

Average weight into courts 8.5 cwt.

Average weight out of courts 10.0 cwt. Range 9.5 - 11.2 cwt.

Average weight for the period 9.25 cwt.

S.E. per day for maintenance 6 lb.

∴ Total S.E. for maintenance 126,918 lb.

Gain 210.25 cwt. plus 2 casualties at say 3 cwt.

Total gain 213.25 cwt.

S.E. per lb. gain 3lb.

∴ S.E. for gain 71,652 lb.

Total starch equivalent utilised by these cattle 198,570 lb.

Average gain per head 1.5 cwt.

Average gain per day 1 lb.

Average No. of days wintered 168

22 cattle in courts 12th February - 30th April, 1957

Average weight of cattle on 26th March 7.43 cwt.

This will be the approximate average weight for the period

Cow days 77 x 22 = 1,694

S.E. per day for maintenance 5.25 lb.

∴ Total S.E. for maintenance 8,894 lb.

Say average gain 1.25 lb. per day at 2.5 lb. S.E. per lb. gain

S.E. for gain 5,294 lb.

Total S.E. utilised by these cattle 14,188 lb.

S.E. utilised by all cattle at Highfield 212,758 lb.

Bonnington

No. of Cattle	Weight In	Weight Out
30	260.75 cwt.	327.75 cwt.

All Fresian cattle Weight out includes estimated weight of 9 cwt. for 1 which died

Average weight into courts 8.7 cwt. Range 7.0 - 9.4 cwt.

Average weight out of courts 10.9 cwt. Range 9.0 - 12.5 cwt.

Average weight for period 9.8 cwt. Cattle into courts 7th November.

Total gain for period 67 cwt.

Cattle out of courts

Date	Number	Cow Days	Date	Number	Cow Days
4/1	4	232	21/5	4	784
19/3	4	560	18/6	2	434
2/4	3	462	16/7	3	777
16/4	5	840	13/1	1	67
30/4	4	728	Total	30	4,884

S.E. per day for maintenance 6.5 lb.

∴ Total S.E. for maintenance 31,746 lb.

S.E. per lb. gain 3 lb.

S.E. for gain 22,512 lb.

∴ Total S.E. utilised by these cattle 54,258 lb.

Average gain per head 2.2 cwt.

Average gain per day 1.6 lb.

Average No. of days wintered 163

1 year old Fresian cattle in courts 23rd November - 13th March

51 cattle for 126 days 8,426 cow days

Total weight into courts 280.9 cwt.

Average 5.3 cwt. Range 3.5 - 6.8 cwt.

Total weight out of courts 307.9 cwt.

Average weight 5.8 cwt. Range 4.1 - 7.25 cwt.

Average weight for period 5.5 cwt.

Gain in weight for group 27 cwt.

S.E. per day for maintenance 4.25 lb.

∴ S.E. for maintenance 35,811 lb.

S.E. per lb. gain 1.87 lb.

∴ Total S.E. for gain 27 x 112 x 1.87 = 5,655 lb.

Total S.E. utilised by this group 41,466 lb.

S.E. utilised by all cattle at Bonnington 95,724 lb.

Congalton

All cattle in courts 16th October

45 cattle off grass (estimated) 410.4 cwt.

Average 9.12 cwt.

25 Irish cattle (estimated) 250 cwt.

Average 10 cwt.

∴ Total weight into courts 660.4 cwt.

Average weight 9.4 cwt.

Total weight out of courts 816.1 cwt.

Average weight 11.8 cwt.

1 casualty Mid January at say 9 cwt.

Total weight out of courts 825.1 cwt.

Gain for period 164.7 cwt.

Cattle out of courts

Date	Number	Cow Days	Date	Number	Cow Days
27/2	8	1,080	11/5	25	5,200
26/3	15	2,430	15/1	1	92
22/4	21	3,969	Total	70	12,771

Average weight for the period 10.6 cwt.

S.E. per day for maintenance 6.75 lb.

Total S.E. for maintenance 86,204 lb.

S.E. per lb. gain 3.25 lb.

Total S.E. for gain 164.7 x 112 x 3.25 =
59,051 lb.

Total S.E. utilised by this group 145,225 lb.

Average gain per head 2.4 cwt.

Average gain per day 1.7 lb.

Average No. of days wintered 182

40 suckled calves wintered in courts 16th October 1956 -
31st March 1957. 166 days 6,640 cow days

Estimated average weight for the period 5 cwt.

S.E. per day for maintenance 4 lb.

S.E. required per lb. gain 1.8 lb.

Estimated gain of 1 lb. per day

Total S.E. per gain 11,952 lb.

Total S.E. utilised by this group 38,512 lb.

S.E. utilised by all cattle at Congalton 183,767 lb.

West Fortune

78 Mixed Irish cattle grazed on farm taken into courts 1st November, 1956.

Weight into courts (estimated) 666.12 cwt.

Average weight 8.54 cwt.

Weight out of courts 835.25 cwt.

Average weight 10.71 cwt. Range 9.75 - 12.5 cwt.

Cattle out of courts

Date	Number	Cow Days	Date	Number	Cow Days
21/1	4	328	17/4	8	1,224
6/2	6	588	19/4	28	4,760
11/2	4	412	22/4	10	1,730
21/3	18	2,538	Total	78	11,580

Average weight of cattle for period 8.73 cwt.

S.E. required per day for maintenance 5.875 lb.

S.E. for maintenance for wintering this group 65,138 lb.

Gain 169.13 cwt.

S.E. per lb. gain 3 lb.

Total S.E. for gain 56,828 lb.

Total S.E. utilised by this group 121,966 lb.

Average gain per head 2.17 cwt.

Average gain per day 1.67 lb.

Average No. of days wintered 148

16 Stirks weight into courts (estimated) 7.5 cwt. each

weight out of courts (estimated) 9.5 cwt. each

Average weight for the period 8.5 cwt.

In courts 1st November - 14th March 134 days

S.E. per day for maintenance 5.75 lb.

∴ Total S.E. for maintenance = 134 x 5.75 x 16 = 12,328 lb.

Estimated total gain 32 cwt. at 2.5 lb. S.E. per lb. gain

∴ S.E. for gain 8,960 lb.

S.E. utilised by this group 21,288 lb.

57 calves of same batch as Congalton wintered from 1st November - 14th March.

Estimated average weight for the period 5 cwt.

S.E. per day for maintenance 4 lb.

Total S.E. for maintenance = 4 x 57 x 134 = 30,552 lb.

Gain @ 1 lb. per day and 1.8 lb. S.E. per lb. gain

Total S.E. for gain 13,748 lb.

Total S.E. utilised by this group 44,300 lb.

S.E. utilised by all cattle at West Fortune 187,554 lb.

CATTLE IN COURTS WINTER 1957-58

		Highfield
No. of Cattle	Weight In	Weight Out
137	1289.375 cwt.	1464.25 cwt.

These cattle were mainly Irish but there were 22 lighter Home Bred cattle in the lot.

Average weight into courts 9.4 cwt. Range 7.5 - 11.75 cwt.

Average weight out of courts 10.7 cwt. Range 9.25 - 12.5 cwt.

Average weight for the period 10.2 cwt.

Total gain for the period 119.25 cwt.

Cattle out of courts

Date	Number	Cow Days	Date	Number	Cow Days
7/1	4	304	1/4	8	1080
14/1	4	332	8/4	8	1336
21/1	4	360	9/4	1	168
28/1	4	388	15/4	8	1392
4/2	4	416	22/4	8	1448
11/2	6	666	29/4	8	1504
18/2	6	708	6/5	8	1560
25/2	6	750	13/5	8	1616
4/3	6	792	20/5	8	1672
11/3	6	834	27/5	9	1962
18/3	7	1022	Total	137	21,228
25/3	6	918			

S.E. per day for maintenance 6.5 lb.

Total S.E. for maintenance 137,982 lb.

S.E. per lb. gain 3 lb.

Total S.E. for gain 58,758 lb.

∴ Total S.E. utilised by these cattle 196,740 lb.

Average gain per head 1.3 cwt (approx.)

Average gain per day 1 lb.

Average No. of days wintered 155

50 Irish cattle in courts 3rd February - 21st April, 1958

77 days 3,850 cow days

Average weight for the period (estimated) 7.5 cwt.

Average gain (estimated) per day 1 lb.

S.E. per day for maintenance 5.25

Total S.E. for maintenance 20,213 lb.

S.E. per lb. gain 2.5 lb.

Total S.E. for gain 9,625 lb.

Total S.E. utilised by this group 29,838 lb.

50 Irish cattle in courts 24th February - 21st April, 1958

56 days 2800 cow days

Average weight for the period (estimated) 8 cwt.

Average gain (estimated) per day 1 lb.

S.E. per day for maintenance 5.5

Total S.E. for maintenance 15,400 lb.

S.E. per lb. gain 2.5 lb.

Total S.E. for gain 7,000 lb.

Total S.E. utilised by this group 22,400 lb.

S.E. utilised during winter by all cattle at Highfield = 248,978 lb.

= 84.2% efficiency.

Bonnington

21 Two-year-old Fresians into courts 24th October.

Total weight into courts 183.5 cwt.

Total weight out of courts 230.5 cwt.

Cattle out of courts

Date	Number	Cow Days
23/3	6	900
8/4	8	1384
15/4	7	1162
Total	21	3446

Average weight into courts 8.75 cwt. Range 7.25 - 9.5 cwt.

Average weight out of courts 11 cwt. Range 9.00 -12.5 cwt.

Average weight for the period 9.87 cwt.

S.E. per day for maintenace 6.5 lb.

Total S.E. for maintenance 22,399 lb.

Total gain 57 cwt.

S.E. per lb. gain 3 lb.

∴ S.E. for gain 19,152 lb.

∴ Total S.E. utilised by these cattle 41,551 lb.

Average gain per head 2.25 cwt.

Average gain per day 1.85 lb.

Average No. of days wintered 164

56 one year old Fresian calves grazed at Bonnington summer 1957, all into courts 24th October 1957

Total weight into courts 360.475 cwt.

Total weight out of courts 429.475 cwt.

Cattle out of courts

Date	Number	Cow Days
20/3	10	1470
17/4	46	8004
Total	56	9474

Average weight into courts 6.4 cwt. Range 5.5 - 7.75 cwt.

Average weight out of courts 7.65 cwt.

Average weight for the period 7 cwt.

S.E. per day for maintenance 4.5 cwt.

Total S.E. for maintenance 42,633 lb.

Total gain 69 cwt.

S.E. per lb. gain 2 lb.

Total S.E. for gain 15,456 lb.

Total S.E. utilised by this group 58,089 lb.

Average gain per head 1.25 cwt.

Average gain per day 0.7 lb.

Average No. of days wintered 178

Total S.E. utilised by all weighed cattle at Bonnington = 99,640 lb.

Congalton

92 cattle into courts 3rd November, 1957

Total weight into courts 860.25 cwt.

Average weight into courts 9.35 cwt.

Heavy cattle out of courts

No.	Type	Total Weight
41	Homebred Black	474.75 cwt.
13	Irish	145.0 cwt.
10	Heavy Fresians	129.5 cwt.
28	Young Fresians	278.5 cwt.
92		1027.75

Average weight out of courts 11.2 cwt. Approx.

Average weight for the period 10.3 cwt.

Cattle out of Courts

Date	Number	Cow Days	Date	Number	Cow Days
21/1	13	1040	16/4	18	2970
8/3	12	1512	30/4	2	358
13/3	10	1310	17/5	26	5096
9/4	11	1738	Total	92	14024

Total gain for the period 167.5 cwt.

S.E. per day for maintenance 6.5 lb.

∴ Total S.E. for maintenance 91,156 lb.

S.E. per lb. gain 3 lb.

Total S.E. for gain = 167.5 x 3 x 112 = 56,281 lb.

Total S.E. utilised by this group 155,449 lb.

Average gain per head 2.8 cwt.

Average gain per day 2.0 lb.

Average No. of days wintered 157.

40 suckled calves wintered 3rd November, 1957 - 9th April, 1958 = 158 days

Estimated average weight for the period 5.5 cwt.

S.E. for maintenance 4.25 lb. per day

Total S.E. for maintenance 26,860 lb.

S.E. per lb. gain 1.8 lb.

Estimated gain of 1 lb. per day

Total S.E. for gain 11,376 lb.

Total S.E. utilised by this group 38,236 lb.

Total S.E. utilised by all cattle at Congalton 186,673 lb.

West Fortune

No. of Cattle	Weight In	Weight Out
94	897.25 cwt.	1016.5 cwt.

This was a mixed batch of Irish cattle of which 78 came in from grazing at West Fortune the previous summer and 16 were bought in Autumn 1957.

Date into Courts 26th October, 1957.

Average weight into courts 9.5 cwt. Range 7.75 - 11 cwt.

Average weight out of courts 10.8 cwt. Range 9.25 - 12 cwt.

Average weight for the period 10.2 cwt.

Total gain for ther period 119.25 cwt.

Cattle out of courts

Date	Number	Cow Days	Date	Number	Cow Days
13/1	10	790	31/3	10	1550
22/2	16	1904	2/4	10	1570
8/3	6	798	5/4	29	4640
10/3	13	1755	Total	94	13007

S.E. per day for maintenance 6.5 lb.

Total S.E. for maintenance 84,546 lb.

S.E. per lb. gain 3 lb.

Total S.E. for gain 40,068 lb.

Total S.E. utilised by these cattle 124,614 lb.

Average gain per head 1.3 cwt.

Average gain per day 1.1 lb.

Average No. of days wintered 138

80 suckled calves wintered in courts 2nd November, 1957 to 21st April, 1957

171 days 13,680 cow days

Estimated average weight for the period 5.5 cwt.

S.E. per day for maintenance 4.25 lb.

Total S.E. for maintenance 58,140 lb.

S.E. required per lb. gain 1.8 lb.

Estimated gain of 1 lb. per day

Total S.E. for gain 24,634 lb.

Total S.E. utilised by this group 82,774 lb.

S.E. utilised by all cattle at West Fortune 207,388 lb.

APPENDIX

Survey of Roots v Silage Farms

Beef Cattle Winter 1956-57

Farm	Acreage of Crops: Hay	Silage	Beet Tops	Bullocks ≤1	1-2 cows & bulls S.E. per day: 6	8	7	Total S.E. per day	Total S.E. for 154 days	S.E. from hay	S.E. from beet tops	S.E. from silage	S.E. per acre From silage
Little Pinkerton	0	37	-	27		13		468	72,072	-	-	72,072	1,948
Mungoswells	15	29	25	38		42	41	1,041	160,314	18,000	50,000	92,314	3,183
W. Byres	20	21	-	41		-	-	451	69,454	24,000	-	45,454	2,164
Ferrygate	10	27	19	15	47	8	36	763	117,502	12,000	38,000	67,502	2,500
Totals	45	114								54,000		277,342	2,433

Hay plus silage 159 acres

Total S.E. from 45 acres hay and 114 acres silage (159 acres) = 331,342 lb.
= 2,084 lb. per acre.

Roots

												from swedes	from swedes
Upper Bolton	12	15	-	25		27		491	75,614	14,400	-	61,214	4,081
Huntlaw	12	26		20	28		38	654	100,716	14,400	-	86,316	3,320
Longniddry	20	20	20	90				990	152,460	24,000	40,000	88,460	4,423
Waughton	35	27		70		15		896	137,060	42,000	-	95,060	3,521
S. Belton	21	22	21	37	34	15	29	943	143,836	25,200	42,000	76,636	3,483
Skateraw	18	27	18	71	20	23		1,085	167,090	21,600	36,000	109,490	4,055
Stonelaws	55	51	-	167				1,837	282,898	61,200	-	221,698	4,347
Ormiston E. & M. Mains	28	30	-	84				924	142,296	36,000	-	106,296	3,543
Tynemount	15	23	-	52			21	719	110,726	18,000	-	92,726	4,031
Elphingstone Tower	29	25	-	79				869	133,826	30,000	-	103,826	4,153
Totals	245	266								286,800		1,041,722	3,916

Hay plus silage 511 acres

Total S.E. from 245 acres Hay and 266 acres roots (511 acres) = 1,328,522 lb.
= 2,600 lb. per acre.